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Securing Sensitive Digital Data in Educational Institutions using Encryption Technology

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Abstract— Recently, modern technologies have made a positive contribution to most institutions of the society. However, they have generated serious issues with regard to the data security. For example, in the educational sector, most educational institutions have huge amounts of various types of data, which require rigorous protection ways to ensure their security and integrity. This study aims at reviewing the most recent data security methods, particularly the existing common encryption algorithms as well as designing an electronic system based on efficient and trusted ones to protect academic and nonacademic digital data in educational institutions. The study applies the satisfaction questionnaire as instrument to evaluate the proposed system efficiency. The questionnaire has been presented to the evaluation team whose members are divided into two groups: experts and end users. The results of the evaluation process have indicated that, the satisfaction ratio of the proposed system is encouraging. The overall satisfaction percentage is 96.25%, which demonstrates that the proposed system is an acceptable and suitable choice for various security applications.

Keywords—Educational Institutions; Data Security; Encryption Technology; Advanced Encryption Standard

I. INTRODUCTION

Over the past few years, an outbreak in computing, information technology and communications has taken place, with all indicators assuring that technological advancement and the use of information technology is going to develop quickly. The foreseen advancements are expected to provide remarkable merits, but are expected to pose major challenges at the same time [1]. As part of the real world, educational institutions use the latest technological means such as cellular devices, iPads, iPods, computers and various internet services at all educational and administrative levels [2].

It is a matter of fact that the data is one of the most valuable sources for any organization regardless of its type, size, products and services [3]. For example, the educational institutions handle multiple types of personal identification data, such as social security numbers, credit card numbers, driver's license numbers, passport numbers, addresses, phone numbers, bank account numbers, medical information and other sensitive data which can be subject to attack and penetration. On the other hand, they focus on research topics which give them an authorized access to confidential

government and/or business intelligence data, scientific data, or military confidential information. Therefore, the potential data security risks in educational institutions constitute an urgent issue which requires conducting laborious research [4].

In practice, the list of potential risks shared by the various educational institutions is so long, with the most important risks being [5]:

(*Theft*): It refers to well-planned attacks that aim to penetrate the security systems of both institutions and individuals for accessing their sensitive data. Examples include hacking district human resources records to get the employees' data by installing malware with encryption that holds data hostage until getting a ransom.

(*Loss*): It refers to losing the equipment and tools accidentally. For examples, misplacing files during storing them or forgetting laptops anywhere.

(*Neglect*): It refers to protecting data in an inappropriate way, making it vulnerable to hacking or theft, such as selling outdated computers without erasing the data stored on them thoroughly or saving datasets on digital media with a weak password.

(*Insecure Practices*): It refers to using insufficient cautions when applying various operations on data. For example, sending a student achievement data over an unprotected email.

Currently, the development of modern technology has a huge number of positive effects on various aspects of life. However, it also has some adverse effects such as the widespread use of eavesdropping tools which give attackers unauthorized access to data, enabling them to misuse and control sensitive and confidential data more quickly and rapidly. This issue prompts individuals and organizations to use a number of security measures to protect their assets during storage and transmission especially in computer network-based systems [6]. One of the most powerful common ways to ensure data security is the "Encryption Technology" [7].

Encryption (also called cryptography) is the science or art of secret writing which provides different levels of data protection. When it was first introduced, it was applied in the diplomatic and military organizations. However, it was soon extensively used in other fields such as e-commerce, protection

of medical records, transmission of military orders and securing email communications. However, the appearance of this technology is affected by the way used to send prepared email messages from one person to another. Emails are traditionally sent in two ways by sending the target message without a cover or an envelope or by scrambling the target message inside an envelope. Since, both ways did not prove to be effective in providing the desired level of data protection, which led to developing the encryption schemes for hiding secret messages effectively by devising and using more sophisticated techniques [8].

Generally, encryption algorithms are grouped into two main categories [9]:

(Symmetric key based encryption): In this type, the same key is used to encrypt and decrypt the target data.

(Asymmetric key based encryption): In this type, two different keys are used: one in the encryption phase and another in the decryption phase.

The main goal of the current study is to protect the content of digital text files used in the educational sector by providing an electronic system based on encryption technology for securing the sensitive text data used in the different types of educational institutions. The study is organized in a number of sections. Section II discusses the background needed for the study; section IV defines the study problem; and section V presents the proposed system details. Section VI reviews in detail the procedures of system evaluation. Finally, the conclusion remarks and the future works are presented in the last section.

II. BACKGROUND

The research background includes:

A. Encryption Terms

The standard concepts in the field of encryption include[10]:

- 1) *Encryption:* This concept refers to the process of applying a mathematical function that transforms all contents of the desired file into another an unreadable form. This new form makes it difficult for anyone to read the file without decrypting it.
- 2) *Keys:* This concept refers to the process of locking the target file using a public key to generate the locked file; while the adverse process is done to unlock the locked file using a private key.
- 3) *Key Pair:* This concept refers to two types of keys, namely public (encryption) and private (decryption) keys.
- 4) *Certificates:* This concept refers to an electronic form used to associate the identity data of a specific individual with a public key.
- 5) *Key and Certificate Management:* This concept refers to all services and operations provided by the encryption system to manage the keys and certificates efficiently without any common administrative constraints.

- 6) *Public Key Infrastructure:* This concept refers to an effective keys and certificates management approach which depends on many security services, such as encryption, digital signatures, authentication ...etc.

B. Encryption Techniques

The common techniques in encryption area are:

1) Data Encryption Standard

The Data Encryption Standard (DES) is one of the most popular early methods used in data security. The DES algorithm refers to the Data Encryption Algorithm (DEA) which is the output of the improvements made on an older system called LUCIFER, produced by the International Business Machines Corporation (IBM). Under the supervision of "Horst Feistel" in the late 1960s, IBM set up a research project in the field of computer cryptography. This project concluded in 1971 with the development of an algorithm known as "LUCIFER (FEIS73)", which was sold to Lloyd's of London to use it in cash-dispensing services. LUCIFER is one of the earliest block ciphers which operate at the block level rather than the bit level. In this approach, each given block is encrypted using a secret key with a key size of 128 bits into 64 bits. The good results produced by Lucifer's approach motivated IMB to cooperate with well-known organizations to develop the original version of the Lucifer approach for commercial use. The development plan was performed under the supervision of "Walter Tuchman and Carl Meyer" and its major outcome was a developed version of LUCIFER characterized by two new characteristics: robustness against cryptanalysis attacks and reduction of the key size to 56 bits making it more suitable to work on a single chip. Responding to the request issued by the National Bureau of Standards (NBS) in 1973, today's National Institute of Standards and Technology (NIST) to propose new approaches to protect digital data at the national level, IBM submitted the refined version of LUCIFER approach. After evaluating all efforts, the modified LUCIFER was largely accepted as the best algorithm among its counterparts at that time. Eventually, it was adopted as the Data Encryption Standard in 1977[11].

In the DES encryption phase, a 64-bit block of plaintext is converted into a 64-bit ciphertext using a secret key with 56 bits. To convert the ciphertext into the plaintext, the procedure for DES decrypting phase is similar to the procedure in the encryption phase, but it is executed in a reverse order [12].

Like any basic block cipher, DES supports the standard modes of operation described in the encryption literature: Electronic Codebook Mode (ECB), Cipher Block Chaining Mode (CBC), Cipher Feedback Mode (CFB), Output Feedback Mode (OFB) and Counter Mode (CTR) [13, 14].

The performance of the DES algorithm has been analyzed and evaluated in many scientific studies. According to [15, 16], the DES has many advantages and disadvantages. Its main advantages include representing the standard of official US Government, representing the standard of ANSI and ISO making it easy to learn & implement and work very fast in hardware based applications. On the other hand, like other algorithms, it is subjected to some aspects of criticism, the most

important two of which are represented in that the used secret key can be easily cracked because of its short size and can be executed relatively slowly in software based applications.

2) Double DES

For improving the performance of the DES algorithm, the first prominent solution reached is the Double DES (2DES). Its main idea is to apply DES twice on the plaintext using two keys to produce the ciphertext. This approach assumes increasing the size of DES security key to 112 bits increases the DES security rates. Thus, if the attacker requires 2^n ($n=256$) attempts to crack the security key in the DES algorithm, s/he will require 2^{2n} attempts to crack two different security keys consisting of n bits. However, this is not usually the case; because the attack uses an unconventional strategy that enables it to use lower attempts to crack the security keys in the Double DES easily. This is the major criticism directed to this method [17].

3) Triple DES

For improving the DES algorithm performance, the second prominent solution reached is the Triple DES (3DES). Its main idea is to repeat the DES algorithm three times on the plaintext using three different keys to produce the ciphertext [18, 19]. In the Triple DES encryption phase, the plain text is encrypted using the first security key (k_1) to produce the first ciphertext, which is decrypted using a second security key (k_2) to produce the second ciphertext, which is further encrypted using a third security key (k_3) to produce the final ciphertext. To convert the ciphertext into a plaintext, the procedure for Triple DES decrypting phase is similar to the procedure in the encryption phase, but it is executed in a reverse order [20].

Like any basic block cipher, the Triple DES supports the standard modes of operation described in the encryption literature: Electronic Codebook Mode (ECB), Cipher Block Chaining Mode (CBC), Cipher Feedback Mode (CFB), Output Feedback Mode (OFB) and Counter Mode (CTR) [13, 14].

The performance of the Triple DES algorithm has been analyzed and evaluated in many scientific studies. According to [21, 22], the Triple DES has several advantages and disadvantages. Its main advantage is providing more security levels than the original DES because the 3DES uses the 168 bits key size while the DES uses the 56 bits key size. On the other hand, like other algorithms, it is subjected to some aspects of criticism, the most important two of which are represented in that more time than the original DES is required and the used 64 bits block size is unacceptable in the applications that requires more security and efficiency.

4) Advanced Encryption Standard

For improving the performance of the DES algorithm, the third prominent solution reached is the Advanced Encryption Standard (AES). When it was necessary to build more sophisticated system than its predecessors, NIST held two conferences on August 1998 and March 1999 to propose a system capable of increasing the security level to make it capable of working efficiently in different environments. After evaluating a large number of common security algorithms based on the encryption technology, Rijndael Algorithm was

selected to test its efficiency rate in the end of 2000. After passing a large number of intensive tests made over five years, it was accepted by the US government. In 2001, NIST published the Rijndael Algorithm under the new name AES which soon became the approved standard for this type of encryption class [23].

Its main idea lies in applying a number of rounds and iterations, with a fixed block size of 128 bits and variable key size of 128, 192 or 256 bits to produce the ciphertext [24]. In practice, the number of rounds depends on the length of the key used in the encryption phase. If the key length is 128 bit, the number of rounds required is 10, while if the key length is 196 bit, the number of rounds needed is 12 [25]. In the AES encryption phase, the plain text is encrypted using a number of rounds; in each round, the plaintext undergoes four types of important operations: SubBytes, ShiftRows, MixColumns, and AddRoundKey. The output of each round is the input of the next one and the output of the final round is the ciphertext. For converting the ciphertext into the plaintext, the procedure used for AES decrypting phase is similar to the procedure used in encryption phase, but it is executed in a reverse order [26].

Like any basic block cipher, AES algorithm supports the standard modes of operation described in the encryption literature: Electronic Codebook Mode (ECB), Cipher Block Chaining Mode (CBC), Cipher Feedback Mode (CFB), Output Feedback Mode (OFB) and Counter Mode (CTR) [13, 14].

The performance of the AES algorithm has been analyzed and evaluated in many scientific studies. According to [27], the AES algorithm has several advantages and disadvantages. Its main advantages are providing high security levels, supporting larger key sizes, running in a short time whether in hardware or software based applications, the ease of implementation and flexibility. On the other hand, like other algorithms it is subject of some points of criticism, including the difficulty of understanding the details of internal operations and the difficulty of recovering the plaintext in the case of losing the secret keys required for decryption phase.

IV. PROBLEM DESCRIPTION

Today, the terrible scientific progress has many impacts on all aspects of life. One of its remarkable impacts is the digital revolution, which changed the forms of data from analog to another kind called zero and one representation. Although this representation provides many advantages associated with data such as ease of copying, moving, deleting, renaming, printing ...etc., unfortunately it makes them easy prey for different types of electronic attacks.

The rapid growth of computer and internet technology creates new challenges related to information security issues. One major example of computer threats is the so-called "Cyber Criminals". The main goal of cyber criminals is how to earn money quickly and easily by stealing the important data of individuals or organizations and selling it to third parties that exploit them in illegal ways.

Since all educational institutions of various kinds, particularly schools and universities have databases containing various data about the institution, and its staff and students,

such databases are liable to electronic attacks by cyber criminals who try to penetrate them in all possible ways.

Accordingly, there is a need for strong defensive strategies in educational institutions to resist the different types of potential electronic attacks efficiently. One of the most familiar and stable methods in data security world is encryption technology.

The aim of the present study is to employ the encryption technology in the education sector by designing an electronic system for securing the content of digital text files in various educational institutions.

V. PROPOSED SYSTEM

For describing the proposed system in a simple and accurate manner, it will be discussed in two separate subsections as follows:

A. System Framework

The system development lifecycle (SDLC) includes a number of successive phases to develop the target software product efficiently. One of the most important of these phases is the "Design Phase". The design phase is concerned with describing the system details (input, processing, output ... etc.) in visual ways by using common drawing tools such as flowchart, data flow diagram, decision tree ... etc. The proposed system design can be simply described by the block diagram given below in Fig. 1.

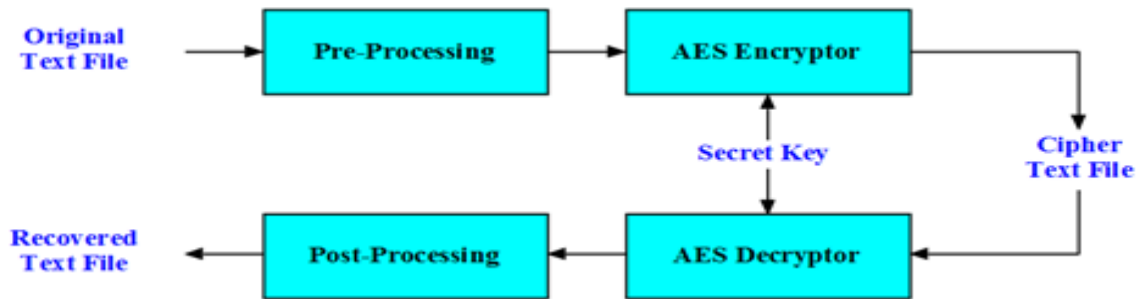


Figure 1. General block diagram of the proposed system

B. Building The System

Practically speaking, the end user needs to use the services provided by the software systems without going through the details of how the internal operations are performed. Therefore, a graphical tool to convert the theoretical system framework

into a real software product is required. The proposed graphical user interface (GUI) is created using Microsoft Visual Studio and the C# language. Some screenshots samples for the first experimental version of the proposed system are shown in Figs. 2–5.



Figure 2. Window of entering login data and selecting target process

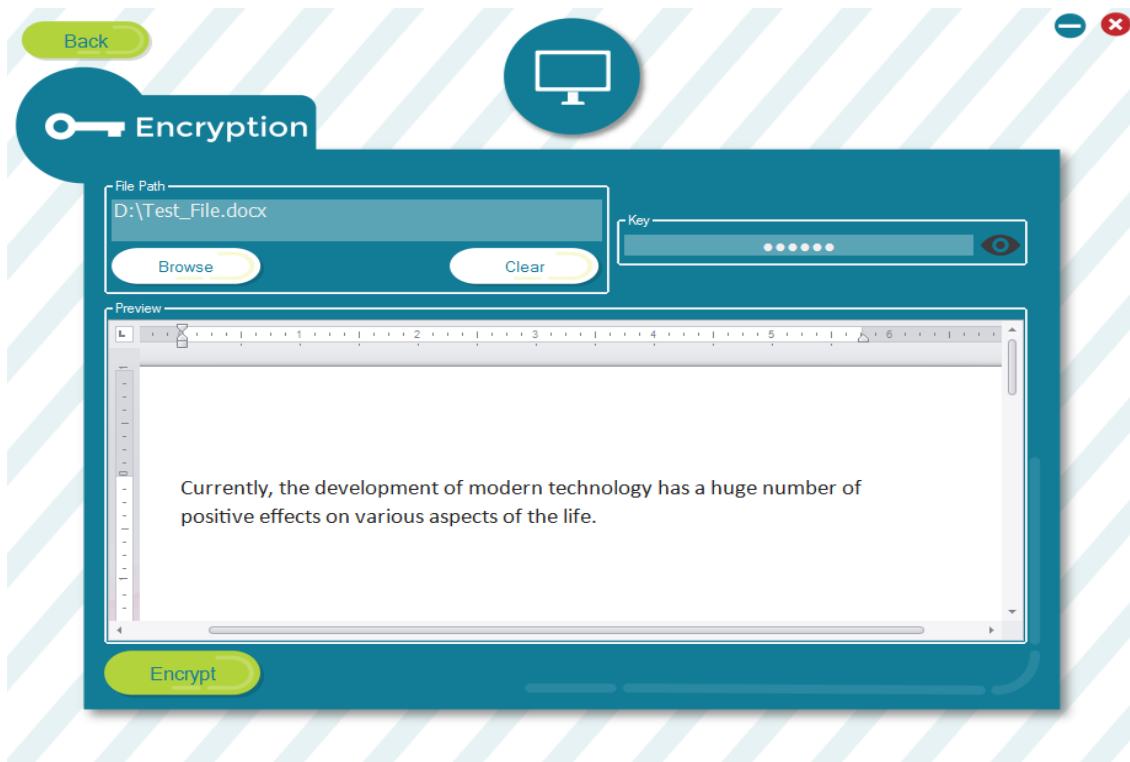


Figure 3. Window of encrypting the original text file



Figure 4. Window of decrypting the cipher text file

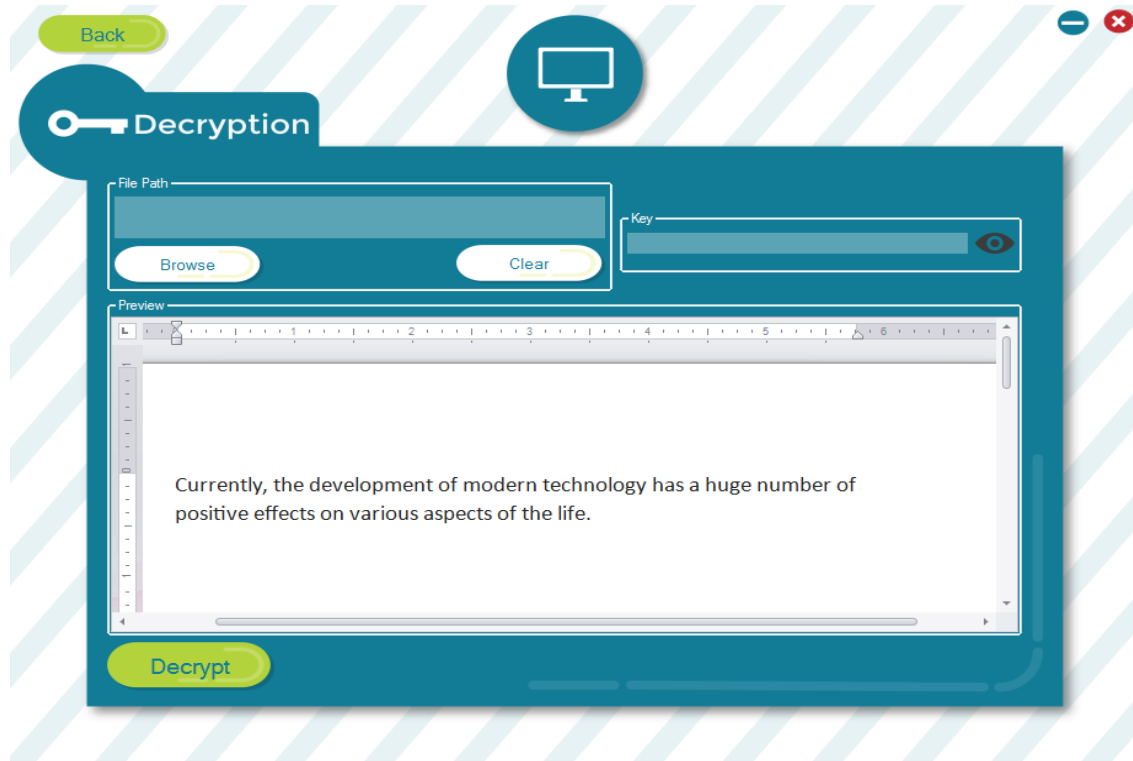


Figure 5. Window of recovering the original text file

VI. PERFORMANCE EVALUATION

To determine whether the proposed system is valid or not, it will be subjected to a set of software tests for measuring its efficiency. This section provides a detailed description of the evaluation plan of the proposed system.

A. Evaluation Parameters

In the SDLC, software evaluation phase is an important part performed through several parameters and arguments as follows:

1) Evaluation Team

For applying the principle of reliability, the evaluation process has been expanded to include two types of viewpoints expressed by experts and end users. Viewpoint 1 is expressed by a group of specialists with expertise in one or more areas of computer sciences. Viewpoint 2 is expressed by a group of end users who represent a large number of the system clients in the real-world workplace environments.

2) Evaluation Scope

In earlier times, the evaluation methodology of software packages was only limited to a single aspect which was the "Goal Achievement". Currently, the process of evaluating software packages has become more comprehensive by including more aspects. The current study evaluates the proposed system with respect to three major aspects as follows:

2.1. Basic Attributes

In this aspect, the proposed system is evaluated with respect to the general terms which must be available on any efficient software product such as run time, memory size, cost ... etc.

2.2. Core Tasks

In this aspect, the proposed system is evaluated with respect to the core functions that should be performed accurately including the two major operations: encryption and decryption.

2.3. User Interface

In this aspect, the proposed system is evaluated with respect to the efficiency of the design of the proposed GUI which includes several criteria such as quality, size, color, position, controls alignment, visual effects, fonts ... etc.

3) Evaluation Tools

In practice, the process of evaluating computer software consists of a set of standard successive steps. Each of these steps includes a number of specific procedures and requires special tools. The data collection step is considered the core of evaluation process. The main goal of data collection is to gather accurate information about the target variables to answer relevant questions and obtain the research outcomes. In the literature, there are a large number of methods used to collect different types of data whether quantitative or qualitative. One of the most popular data collection methods employed in survey research is the "Satisfaction Questionnaire". In this

study, the questionnaire includes a number of questions/statements in multi-choice format about the evaluation scope. This questionnaire is provided to the evaluation team for selecting the most appropriate answer from among a number of choices. The obtained data is categorized and analyzed by descriptive statistics approaches within SPSS software.

B. Experimental Results

In order to ascertain the validity of the proposed system for practical application in real environments, the system has been tested and evaluated in an objective way. This process is carried out by the team specified in section VI-A.1 with respect to the criteria specified in section VI-A.2 using the tool specified in section VI-A.3. The outcomes are recorded and converted into meaningful information. A sample of the detailed results followed by the overall results is shown below in Table 1.

Table 1. The outcomes of the proposed system application

Evaluator Number	Satisfaction Percentage [%]	
	Expert	End User
1	98.33	100.00
2	95.00	99.43
3	93.39	98.86
...
...
N	95.00	89.29
Average [%]	94.39	98.10
Overall Average [%]	96.25	

The statistical results shown in Table.1 indicate that there is variation in the estimation of the proposed system efficiency as shown by the experts' and the end users' feedbacks. The results show that the average level of experts' satisfaction is 94.39% while the average level of end users' satisfaction is 98.10%. This variation supports the opinion that the vision of experts is more comprehensive than vision of normal user. The obtained satisfaction percentage confirms that the proposed system has been accepted by the evaluation committee with overall percentage of 96.25%. Finally, the results revealed that the proposed system achieved its objectives with remarkable success making it an ideal solution in various security applications in the real world.

VII. CONCLUSION AND FUTURE WORK

With digital revolution, the data in digital format is more vulnerable to whether intentional and unintentional infringement. Therefore, data security in digital environments has become a fundamental and serious issue. Educational institutions use many protection tools to keep their data safe from attackers. Encryption technology is considered one of the most efficient tools in this regard, because its main idea is based on converting the original data into an incomprehensible format for others.

The current study presents a symmetric encryption system to protect sensitive digital data in educational sector. The proposed system uses the "AES" algorithm to encrypt the content of text files into an unreadable form that can only be decrypted by using the right secret key. The system effectiveness has been reviewed by an expanded evaluation committee using the satisfaction questionnaire tool. The participants in evaluation process have reported a high level of overall satisfaction (96.25 %), which confirms the validity of the system for real application.

Future work will focus on developing the current system to support other types of digital files such as images, audio files, video files ... etc.

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Evaluating Cloud & Fog Computing based on Shifting & Scheduling Algorithms, Latency Issues and service Architecture

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Abstract— In this study, we propose situations where cloud is suitable and fog is more compatible, also define some services according to the cloud and fog architecture. We also provide a comparison of task scheduling algorithms of cloud computing and determine that fog is a light weight network so which is the best suitable algorithm for fog architecture on the basis of some attributes. The implementations of fog computing are challenging in today's computational era; we define some reasons in which fog computing implementation is difficult.

KEYWORDS:

Cloud and Fog computing, scheduling, Internet of Things (IOT), fog nodes.

I. INTRODUCTION

Today cloud services come with some obvious benefits, cloud data centers are centralized and, typically far from the end user resulting in high access latencies (Mell & Grance, 2011). A lot of companies i.e., Google, Amazon, Microsoft and many other companies increased their speed in development of cloud computing systems in order to enhance cloud services that are provided to many users (Zhu, Jiang, et al. 2013). At this point when information sources are distributed over numerous areas and low latency is necessary, cloud information preparing fails to meet this need. The reason for building such condition is to collect information from IoT gadgets to perform optimization, pattern detection and predictive analysis to make smarter decisions timely (Misra, Prasant, et al. 2015).

The phrase “Fog computing” also termed as edge computing, is a decentralized architecture unlike cloud computing where central mainframe is required to access data (Kitchin & Rob. 2014). Fog computing is designed to serve as an extension to cloud computing by grouping many edge nodes. That provides sufficient amount of management and configuration, and localized control. Fog computing serves at the edge of the network (Cortés, Rudyar, et al., 2015), it permits cloud

computing to extend their services to the edge of the network to make their services more accessible (Gupta, 2017).

Following key Questions are answered in this paper:

- What type of services need fog computing rather than cloud computing architecture?
- How Fog will reduce service latency to Improve QOS?
- Either shifting of user data from one fog node to another face any interruption or not?
- Which efficient scheduling algorithm should be used to shuffle data among devices without interruption of data among fog nodes?

Method: Systematic research methodology is undertaken, Articles enumerating emergence of fog computing and cloud computing and comparison of services of Fog and cloud computing as well as the comparison of different scheduling algorithms are identified.

Literature review:

According to Ivan Stojmenovic Sit, Shen Wen, Fog Computing isn't a substitution of cloud but a point ahead to it. As Cloud, as well as Fog computing also provides application services, data (computation etc.) to end-users (Behrisch, Michael, et al., 2011). The main variance is Fog computing services to its nearest or closest user thorough its node that is close to user geographically that provides mobility, also termed as edge network (Aazam, Mohammad, et al., 2015). Low latency and quality of service is achieved through fog computing (Dsouza, Clinton et al., 2014). Fog figuring is most appropriate for analytics and real-time big data as per Cisco because of its wide localized distribution.

II. WHY THERE IS NEED OF FOG COMPUTING?

A current study of Endomondo (Yuan, Mugen et al., 2018) sport activity analyzing application has exposed number of

noteworthy opinions? This review indicates that an activity produces 170 GPS; maximum tuples can be 6.3 million in a specific period. Estimated study indicates that till 2020 with 30 million user's data generated by Endomondo can be 25,000 per second (Cortes, Rudyard, et al., 2015). So with this rapidity Centralized cloud servers cannot deal in real-time (Zhu, Jiang, et al, 2013). The users of cloud especially privacy conscious are not comfy with this. This inspires the need of alternate the model that is accomplished of more computational nodes that are nearer to the user than cloud with internet connection, also can construct local views of data and can perform further offload computations. Fog computing has arisen to this end.

III. COMPARISON OF CLOUD COMPUTING AND FOG COMPUTING

Table 1: Comparison matrix of cloud computing and fog computing

Attributes	Cloud Computing	Fog computing
Geo Distribution	Centralized	Decentralized
Latency	Predictable and high	Low than cloud computing
Need of Internet connection	Need constant and high speed internet connection	Perform offload computational operations
Reliability	High standard (trusted)	Less than cloud computing
Repairing	User is not concerned about repairing	Maintenance is more difficult and costly
Network connectivity	Guaranteed but with heavy latency	Unreachable (all the time same node is not accessible)
Cost factor	Costly as CAAS perspective	Auditing of hardware is costly
Scheduling	Un-necessary latency un scheduling	complex
Service	Provide service from its core architecture	Provide service from the edge of the network
Maintained or owned by	Single motivated organization	Can be implemented by many independent agents
Power consumption	More power consumption	Power efficient
Heterogeneity in nature	Heterogeneous in services perspective	Heterogeneous in device (node) specification
Location of the services	Within the network (from its core architecture)	From the edge of the local network
Client sever distance	Multiple hops	Single hope
Security	Undefined	Can be defined
Distance between server and client	Numerous hops	One hop

IV. WHAT TYPE OF SERVICES NEED FOG COMPUTING RATHER THAN CLOUD COMPUTING ARCHITECTURE?

Some characteristics like mobility, cloud integration, communication protocols, computing resources and distributed data analytics are supported by Fog computing that acquire low latency with wide range and in dense geographical distribution fog improve quality of services, decrease the rate of latency of services requests (Zhu, Jiang, et al., 2013), that results in a better user experience.

A. Architecture of Fog computing

There are three logical layers in fog network architecture. Each device is capable enough to provide storage, host computations, and provides offload computational operations (Chiang, Zhang 2016), (working like online- to some extent)

- **Device Layer:** All the devices that are connected to the fog network through nodes are included in this layer i.e., IoT devices e.g., gateways, sensors, and smart phones like tablets, mobile devices etc. it is possible that these devices are using peer-to-peer communication among themselves (Zhu, Jiang, et al., 2013) or may be exchange data directly with the network. The word "data" is plural, not singular.
- **Fog Layer:** All the intermediate network devices that are placed between end devices and cloud layer are part of this layer (Gupta1, Chakraborty S. et al., 2016). These intermediate network devices decrease the rate of burden on Cloud Layer. The word "data" is plural, not singular.
- **Cloud Layer:** In hierarchical architecture of these three layers, this layer is at apex; (Rehman, Jayaraman et al., 2017) at this point cloud virtual machines provide offload computations. Handling intensive computation, high processing and need of large storage is possible in cloud infrastructure (Rehman; Liew, et al. 2014) due to its infinite scalability and high end performance.

B. Services that fog architecture supports:

- **Reduction of network traffic:** Billions of devices use internet to send, receive, and generate data every few second. It is not sensible and efficient to send all raw data on cloud. There are 25 billion connected devices, estimated by cisco. It is the need of modern era to implement an architecture in which they use devices that are capable enough of being closer to the customer to reduce latency that lead towards improves quality of service (Cao, Yu, et al., 2015). Here fog computing severely reduces this burden on cloud. Fog computing provides a platform where generated data is analyzed and filtered also capable of closed to edge of the network (Stantchev, Vladimir, et al., 2015).
- **Appropriate for IoT (Internet of Things) queries and tasks:** Due to increasing trend of smart devices, many requests influence their surrounding devices. This type of requests can be handled without acquiring

global information at cloud that's why fog is suitable for IoT Tasks. For example, here we will discuss the above mentioned scenario Edomondo (Luan; Gao; et al. 2015), by using this support tracker application user locate the similar support in their nearby locations, as it is clear that these types of requests are from local area, so fog infrastructure is better to handle such requests and IoT devices instead of using cloud infrastructure.

- **Low latency requirement:** Applications that are mission critical need real time data processing. Let's take an example of robotics, its motion is controlled by feedback of the control system, and data collected from sensors. Having this control system on cloud may make it slower or may be unavailable sometime that may result in communication failure (Rehman, Liew, et al. 2014). Here fog computing performs its role. Fog computing can help by performing real time processing required for controlling (Rehman, Liew, et al. 2014). Because fog nodes are very close enough to the robots. This is how Fog architecture makes real time response and communication possible.
- **Scalability:** Due to increased number of devices there is infinite number of virtual resources. It is overhead for cloud to handle if we upload all the crude data created by nodes on cloud (Rehman, Liew, et al. 2014). Rather than that the Aim of fog computing is to process data from incoming closer device. This infrastructure reduces the burden from cloud servers (Zhu, Jiang, et al., 2013). This is how fog overcomes the scalability issue of cloud computing by using its end nodes.
- **Security and Reliability:** In Cloud architecture it is most challenging task to implement security over it. Authentication implementation at several levels of fog nodes is a main task (Trovati, M. 2017). Possible results that may show to be valuable for this authentication problem in fog computing are Trusted execution environment (TEE) techniques (Patty, Penn, 2015) Public Key Infrastructure and also Measurement based methods also reduce authentication cost.
- **Resource Management:** For IoT applications that perform efficient and effective management of resources offering a service oriented resource management model for fog computing (Yang, Zhang, et al. 2014). Fog for competent process of fog sensible management of resources is important. Aazam et al. as usual servers of cloud that has resource capacity, merely fog devices match (Wang, Lu, et al. 2013).

V. HOW FOG WILL REDUCE SERVICE LATENCY AND IMPROVE QUALITY OF SERVICE (QOS)?

As the fast growth of IoT applications, the traditional centralized cloud computing is encountering severe challenges, such as high latency, low spectral efficiency (SE),

and nonadaptive machine type of communication (Fu, Jiang, et al. 2012). The evolving IoT presents new challenges that cannot be effectively addressed by the central cloud computing architecture, such as resource-constrained devices, stringent latency, uninterrupted services, capacity constraints with alternating connectivity, and enhanced security (Dong, Dougli, et al. 2017). Fog computing is acting like smart gateway that performs following tasks:

- **Local Connectivity:** Fog gateway directly contact with sensors to gain data and to deliver actuations such as alerts and notifications.
- **Computation:** for comprehensive analysis Fog gateway handles the incoming data to produce logs that are sent to the cloud.
- **Onsite Database:** It forms a local database encompassing features that internally and externally can be queried.
- **Data Security:** To protect the data and user identity, it provides security layer.

In the context of big data an auspicious tactic is Fog computing, a lot of possible operations can be possible due to this (Zerbino & Birney, 2008), Mobile edge devices have some computational capabilities, that deployed an imaginary data processing architecture called RedEdge (Lin, Chiu, et al. 2013). The mobile edge devices facilitate with data reduction platform the RedEdge model. The big data systems enhanced its Value, velocity and volume, RedEdge architecture is used to reduce data into streams (Randles, Lamb et al. 2010) before storing big data, RedEdge reduce the amount of big data. This reduction of data is based on following factors:

- (1) High dimensional datasets are reduced into streams of low dimensional data-sets
- (2) by graph mapping and optimization algorithms in network theory-based methods;
- (3) The volume of network traffic can reduce in order to applied compression algorithms;
- (4) Redundant and replicated data eliminate through data deduplication methods;
- (5) With the help of data filtration methods and feature extraction, data streams can be reduced at early stages;
- (6) Data reduction of Big data can be managed at early stages with machine learning and datamining techniques

VI. DOES A PROCESS RUNNING ON FOG NODE BE INTERRUPTED WHEN THE USER MOVES TOWARDS ANOTHER FOG NODE?

No, fog node cannot be interrupted by another fog node because from nearby devices the data accumulated in Fog Data is time-series along with time-stamps (Subramanian, Krishna et al., 2012). These log files help in debugging the software programs for certain use cases. Thus, it is known what data is collected and at what time. Along with other important factors data collection is accompanied with a log

file that stores the time-stamps of data acquirement. The log files are .xls files

VII. WHICH EFFICIENT SCHEDULING ALGORITHM SHOULD BE USED TO SHUFFLE DATA AMONG DEVICES WITHOUT INTERRUPTION OF DATA AMONG FOG NODES?

There are many technologies that are developed to meet the need of “busy users” in the modern era of competition. In order to reduce latencies and offer better QoS, fog computing architecture executes workload of computations on the edge nodes of network, that are nearer to the user (Kokilavani & Amalarethnam, 2011). This architecture of for computing

results in reduction of latency in communication between edge nodes and users (Varghese, Wang, et al. 2017). Modern technologies have more users if they can address user's demands without adding more workload on these technologies (devkota, Ghimire, 2017). Task scheduling algorithms directly affect the efficiency of resource utilization and also to the proficiency of users' tasks. There are a lot of task scheduling techniques or algorithms that is used in cloud to balance the load (Raghava & Singh, 2014). A comparison matrix of different scheduling algorithms is given below with respect to different attributes.

Table 2: Comparison matrix of different Scheduling Algorithms

<i>Algorithms</i>	<i>Attributes</i>							
HoneyBee Foraging (Mao, Chen, et al. 2014)	No Throughput	No Overhead	No Fault Tolerance	No Migration Time	No Response Time	Resource Utilization available	No Scalability	No Performance
Active Clustering (Wickremasinghe, 2009)	No Throughput	Overhead available	No Fault Tolerance	Migration Time	No Response Time	Resource Utilization available	No Scalability	No Performance
PALB (Kaur, 2012)	Throughput available	Overhead available	Fault Tolerance available	Migration Time available	Response Time available	Resource Utilization available	No Scalability	No Performance
Round Robin (Wang, Yan, et al. 2010)	Throughput available	Overhead available	No Fault Tolerance	No Migration Time	Response Time available	Resource Utilization available	Scalability available	Performance available
Min-Min (Nine, SQ, et al. 2013)	Throughput available	Overhead available	No Fault Tolerance	No Migration Time	Response Time available	Resource Utilization available	No Scalability	Performance available
Max-Min (Lin, Liu, et al. 2011)	Throughput available	Overhead available	No Fault Tolerance	No Migration Time	Response Time available	Resource Utilization available	No Scalability	Performance available
Active Monitoring (Kaur & Bharti 2014)	Throughput available	Overhead available	No Fault Tolerance	Migration Time available	Response Time available	Resource Utilization available	Scalability available	No Performance
OLB+LBMM (Bonomi, Flavio, et al. 2012)	No Throughput	No Overhead	No Fault Tolerance	No Migration Time	No Response Time	Resource Utilization available	No Scalability	Performance available
Biased Random Sampling (Li, Zhao, et al. 2015)	No Throughput	Overhead available	No Fault Tolerance	No Migration Time	No Response Time	Resource Utilization available	No Scalability	Performance available
Throttled (Li, Zhao, et al. 2015)	No Throughput	Overhead available	Fault Tolerance available	Migration Time available	Response Time available	Resource Utilization available	Scalability available	Performance available

Dynamic Round Robin (Hromic, Phuoc, et al. 2015)	Throughput available	Overhead available	Fault Tolerance available	Migration Time available	No Response Time	Resource Utilization available	No Scalability	No Performance
FAMLB (Vaquero & Rodero-Merino, 2014)	Throughput available	Overhead available	Fault Tolerance available	Migration Time available	No Response Time	Resource Utilization available	Scalability available	Performance available

Fog Computing is also balance the load between the edge nodes but it is light weighted than cloud so it also required an algorithm which is also light weight and satisfy all above mentioned attributes. So, to fulfill the needs of the fog computing there must be an algorithm which will be the combination of two algorithms that perform all the above mentioned features (Wang, Yan, et al. 2010). According to the above comparison an algorithm which will be the combination of FAMLB and Throttled algorithm can fulfill the requirements of fog computing. The frame work of fog computing architecture is not yet available that's why its implementation is difficult and still it is infancy. Fog architecture should be able to fulfill the requirement, i.e., we need such a technology that is capable of processing requests in real-time. Implementation of real-time data processing in fog nodes is still a question mark (Lin, Liu, et al. 2011). Although, current framework of cloud computing i.e., Google App Engine, Microsoft Azure, and Amazon Web Service (Gupta, Chakraborty et al. 2016), are capable of supporting data intensive applications. Furthermore, there will need to be well plain how to develop a framework, that is capable of handling workload on fog nodes. Secondly, how to deal with different types of nodes on which such applications will deploy, i.e., connection policies that presents when to use heterogeneity and edge, and Deployment strategies that show where to place a workload.

VIII. DISCUSSION

This paper reviews the use of fog computing as an extension of cloud computing by analyzing the comparison of fog and cloud. Define some services which fog computing supports and which methods of reduction used to better the Quality of service and control the latency of services. Different scheduling algorithms learn and compared them with each other to determine which will be the best suitable for fog architecture and also define what challenges will face in the implementation of fog computing.

IX. CONCLUSION AND FUTURE WORK

We determine fog computing is essential to facilitate better end user environment to get better and quick real-time response of requests especially for sensitive applications in current era of computations. Also investigate that fog computing provide better quality of service at the edge of the network and the comparison of different scheduling

algorithms define some innovations in compute, storage and scheduling may be inspired in the future to handle data intensive services between different fog nodes. In future we will work on the implementations of the algorithms that will be the best suitable for the fog environment and fulfill all the perspectives of attributes that mentioned to compare algorithms

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A Review of Emotional Intelligence and Conflict Management Styles Towards Leadership in The Workplace

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Abstract: Factors such as; Past rivalry, personality, ego, attitude and approach affect the relationship between emotional intelligence and conflict and clash formation. Conflict arises due to a person's related problems like he thinks he is everything, his style of dealing and behaviour, his thinking and opinions etc. The fundamental factors of the link between emotional intelligence and policy of conflict management are identified as; communication and mutual relationships, interest for self, interest for others and shifting and re-perception of the clash situation. As conflicts can have both positive and negative impacts on organizations, so it's the duty of management to control the role of conflicts by bringing effective leadership for the better and success of the organization. The role should be made and strategy should be applied in such a way that it can minimize the conflict and positive steps in term of leadership among the staff. This review will highlight the present consideration of emotional intelligence (EI) and management styles toward the leadership for the exploration of key areas and lighter for the future direction.

Keywords: Emotional intelligence, Management styles, workplace, leadership.

I. Introduction

The emotional intelligence has witnessed unparalleled interest. Programs and courses on university and school levels are introduced, but what we know about this emotional intelligence? For the description of the motive of emotional intelligence, several schools of thoughts are available. In general, it refers to the capability of bringing emotions in ourselves and others [1]. For the first time, Peter Salovey and John Mayer used the term "emotional intelligence" in publications. Initially, this term was defined as; a type of intelligence that can guide feelings of someone, in favour of them. Latterly the definitions were modified and the current assumption being accepted. Emotional intelligence is stated as the ability to realizing emotion, integration of emotions to facilitate thought, understanding feelings, and movement of feelings for personal growth promoting. [2]. Another dominant researcher of the

emotional intelligence making is Reuven Bar-On, the originator of the term "emotion quotient". According to the author, emotional intelligence is understanding of our self and to deal external surrounding and people [23]. Besides any difference between definitions of this terminology what we say, it will always refer according to standard intelligence.

II. Literature Review: Conceptualization

Whenever there exist differences in opinions, conflicts will arise. The thinking ability of every person differs. Even in the case of resemblance with others thinking, still, differences of opinions and behaving style differs. After facing of different situations introduce further likeness of difference. Every person has their ability and angle of thinking so that conflicts will arise. Conflict situation occurs when two parties either agree or disagree on results. Learning for resolution of conflicts will the target and performance area. According to past research, there are significant relationships between emotional intelligence and dependant styles of handling conflict with supervisors [4], [5] Both the integrating style and compromising style will be preferred by all dependent subordinates for conflict resolution process.

III. Emotional Intelligent

Emotional intelligence is the ability of management of human relationships with each other. For the measurement of this ability emotional quotient is used. The important role is played by emotional intelligence because of the following reasons 1) effective handling of emotions will contribute to handling needs of individuals. 2) How motivations occur and how much appropriate and relax one feels during work time. Those employees who possess a high degree of emotional intelligence can judge accurately, understanding and appraising of others [6]. They are also considered more mutually responsive and understandable [7], defensive of others, less critical and unfruitful, and more likely to turn to the better observer for advice and assistance [2]. According to [9] self-regulation, awareness, social skills, motivation and empathy are the five components of emotional intelligence. Self-awareness is correlated with recognition of

another person internal state, resources, desire and discernment, e.g. the supervisor know about the emotions he or she has experienced. Self-regulation is the ability of recognition of some internal situations of pulses and resources like supervisor is still cool when he or she has to face the cruel situations. Motivation shows the emotional capacity that aid in goal reaching like supervisor face every challenge and sits goals being aware of the others situations, e.g. a supervisor understands the feelings transfer through verbal and non-verbal language. Social skills mean a person will encourage the fascinating feedback in others.

IV. Conflict Management

Conflicts management will result in conditions like fairness, comfortability, success and adaptability [11]. According to [13] conflict can be defined as an "interactive state manifested in incompatibility, disagreement, or difference within or between social entities" (p.13). There are five styles of management for conflict resolutions: integrating, obliging, compromising, avoiding and dominating. Creating engagements between the two parties for the examination of the differences, information exchange and create acceptance to able for a competent solution, e.g. both supervisor and sub followers show the inspiration for a collective commitment to a project, by incorporation of one another ideas into final compromise. Willing can be expressed when one party starts to minimize the differences and to indicate the aims for the other party confirmation like to reach a particular logical conclusion a thought is very much superior. Dominating is that situation when a supervisor bypasses the followers and subordinates in decision making while avoiding is a situation in which withdrawal of solutions occurs like a subordinate does not corporate with the supervisor either physical or mental.

Agreement and compromise are that in which both sides of the parties take and give something to reach a positive conclusion. Integration style was marked as more impressive and avoiding style less impressive by [14]. [15] supported the integration way of dealing much greater than that of compromise way. The leading style aggravates conflicts in an organization while integrating, compromising, and willing lessen conflicts and prove to be effective [16]. An organization that adopts problems solving ways and compromises they gain a higher degree of performance [5], from other studies we can also report that there are positive results of integration style of handling conflicts for organizations [15] [12] [11] [17]. Dominating and avoiding will lead to negative results of disastrous finance and lots of loss occurs if they are driven by low ethical motives [17] [18].

V. Relationship between emotional intelligence and conflict management styles

From the last discussion, we can see that the advances of emotional intelligence can be observed in many areas of life. But the application of its advantages has been mostly documented in the professional workplace. [18] shows four main reasons that how the workplace is a logical setting for evaluating and improving emotional intelligence expertise.

- a) Emotional intelligence capability is important for success in most jobs.
- b) Many of the men enter the workforce without capability that is must for successful or beat at their job.
- c) Employers already have made ways for motivation in providing emotional intelligence training.
- d) Most of the man spend most of their hours on working.

A keen interest in professional activities is also supposed in the way organization to have welcomed E.I ideas. A guideline of volume has been published by American Society for Training and Development, for helping people inside organizations to manage emotional intelligence capability which differentiate outclass performing persons from average person's [18]. From previous research, we can say that a lot of research has focused on effective leadership which is basic workplace quality. Before the research in E.I area started, Ohio State Leadership Studies had noticed that leaders who were able to produce and make mutual trust, respect with the group members are more effective [19]. Many researchers have arguments about this truth that the property of effective leadership is to solve big and complex problems inside organizations and this is not surprising [20] [12][10]. Cost-effectiveness remained the area of interest for emotional intelligence in the workplace. The economic value of staff hires been reported by few authors based on emotional intelligence. In a report to Congress, the Government Accounting [17] defined the amount saved when the United States Air Force used Baron's Emotional Quotient Inventory (EQ-I) to select program rewriters. Those who were selected as successful recruiters by highest score in emotional intelligent saved \$3 million annually.

3. Review Method

Through Systematic Literature Review (SLR) critical evaluation of all the previous research is conducted. Using discipline manner of following step by step criteria for papers selected based on the objectives and then arrange and manage it properly. A systematic review includes proper discussion of the results of collected studies. Many authors have discussed that through this kind of

review and systematic study, a chance of error is less and data is analysed properly. The benefits will obviously observe in the form of better results and will help to conclude the topic and data [16] [13][8] [31]. SLR method was applied for the first time in medicine field [19][22], but now it is applying everywhere in other fields like engineering domain also [23][24]. SLR is conducted in this section for performing a comprehensive study of the mechanisms of emotional intelligence and conflict management. Papers searching and inclusion, exclusion criteria are defined for final selection. All those publications were included in the final list which was written in English, and all opinion driven reports (editorials, commentaries, and letters) were excluded.

3.2. Selection criteria

According to Quality assessment criteria (QAC) suggested by [22], only those papers were selected for study which was published after 2009. The checklist consists of the following questions

- Does the paper include proper research method?
- Is the method of research being suitable for problem solution?
- Are the results of the paper are properly analysed or not?

If it fulfils the criteria filled with 'yes'. Fig.1 shows the inclusion and exclusion criteria for our review protocol.

Table 1: Quality assessment (QA)

Questions	ID
Have the selected objectives been clearly defined for this paper?	QA1
Are the selected papers highlights the issues of emotional intelligence and conflict management?	QA2
Have the data collection method been explained in the paper?	QA3
Does the paper provide sufficient contributions to academic and industry communities?	QA4
Have the findings of the paper clearly explained and	QA5

assisted in the results explanation?	
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3.2 Inclusion and exclusion criteria

The following inclusion criterion was considered for our study: Does the finding results of papers are relevant to emotional intelligent? The respond should be picked by three authors, and they could be: 0= 'exclusive', 1= 'uncertain', and 2= 'include'. Only English written papers were considered. If a conference study had a recent journal version, only the later were considered for inclusion. If the same title has many studies, then only recent studies were concluded. For voting each study, in the first phase the only title, abstract and keywords were reviewed. If these are not enough for information's to be fetched than further depth evaluation was conducted. With the intention that a publication is included in the final review which was part of our research, we considered the following criteria in table 2.

Table 2: Selection criteria

Inclusion	Exclusion
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<ul style="list-style-type: none"> • Only those publications were included that were published in English language only. But sometimes the title is written in English but the rest of the paper can be found in another language like Arabic etc. and the same case also is occurred with us. • Publications were validated regarding the title, abstract and keywords of our topic study. Three criteria had to be considered at this point and had nothing to match each other, because in some the studied publications, the subject and title didn't match each other. However, to validate the keywords or the summary they had material which made us include them in the reference manager. • Journals and all-conference proceedings and some the chapters of books were included and considered for the research and data extraction. • We comprised and constituted publications concerning order of suitability and related; this was decided for the search strings obtaining too many studies despite the filters being properly defined for each search engine by what was included in the first ten most related publications. • Publications were considered by their citations further because the results of search string found too many studies relevant to our work and goals. • Once the first inclusion of our reference manager was done, we performed a second validation: <ol style="list-style-type: none"> I. Impact factor was considered II. Conference categorization III. If online survey exists otherwise, it 	<ol style="list-style-type: none"> a) Those published which were not discussing the results b) Studies conducted on other topics not relevant to ours c) Duplication in publications either of other databases or reference manager d) Publications that are not be found by any way (interlibrary, another database (Research Gate), or directly with the author). e) Proceedings from conferences that were not found in the core. f) Publications that didn't match with inclusion criteria. 	<p>had to be requested.</p>	
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3.3 Search strategy

Search strategy being the important and critical phase of SLR in which papers relevant to research questions are identified [22]. Search strategy defines the way to extract papers from digital libraries. Therefore, we take into account stages associated with the completion of the review, these being :

- a) conducting a search
- b) primary studies selection
- c) quality assessment criteria
- d) data extraction and monitoring
- e) Data synthesis

This subsequently allowed us to move to develop the search strategy, which was based mainly on:

- The searching approach can either be manual or automatic (digital libraries)
- Validation of sources and where to search, all these information's are must.
- Making search string especially preliminary search string to validate the topic and searching it either correct or not
- Make period for the search completion.

Sensitivity and precision are the two ways and concepts that help to evaluate the efficiency of a search strategy for establishing an optimal search strategy. Sensitivity enables us to see the proportion of related studies recovered from our theme and precision shows us the proportion of retrieved studies.

3.4 Selection process

Combination of both emotional intelligence and conflict management styles both are included in our sample for SLR. For the selection of relevant references [22], we use appropriate keywords for each type of source. The set of keywords for the source of type 1 used are: ("emotional intelligence" OR "conflict"). The first set of terms refers to EI. In full texts of papers, the keywords were searched. We used digital sources like ACM digital library, IEEE Explore, Science Direct, Emerald and google scholar. For each source of the library, we limited the search to first forty pages only based on initial tests. The time duration was from 2010 to 2017 for source examination by considering that EI and conflict management styles will grow fast. Several papers were cited using many sources (mostly Google Scholar). Different search results were then combined. We investigated these papers to display artefacts which are already presented in the papers and also for the future research consideration of artefacts. EI, on the other hand, is an emerging issue which has to be considered much high. We have taken into account papers that deal with each of these two domains separately (source of type 2). The process for selecting these papers was similar to the one discussed above for papers on the topic of EI. The difference lies in the choice of keywords: the keywords were specific to each of the related domains and also ensured that only the seminal papers for understanding the domains (literature reviews) were selected. We adopted the selection process from the Prisma group (2009) as showed in Figure 1.

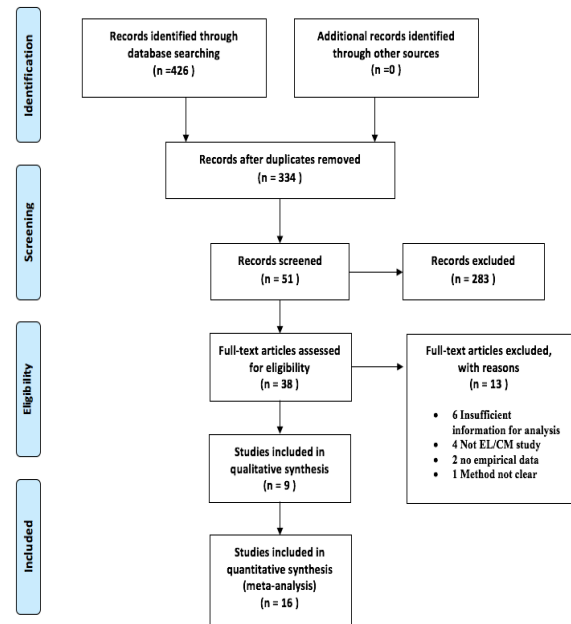


Figure 1: Selection process Adopted from; Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group

4. Discussion

Conflict is defined by [30] as a conflict in opinion between people or groups, due to dissimilarity in attitudes, beliefs, values or needs. In the business world, dissimilarity in such characteristics as work experience, identity, peer group, environment, and position, all lead to dissimilarity in personal attitudes, beliefs, values or needs. Otherwise, there is no such other practical definition of conflict at all. Whenever there exist differences in thinking pattern etc. conflict will exist. No two-people thinking can be similar. Even if a person agrees with you still have a different point of view of thinking. The action of people in different circumstances introduces further likelihood of difference. Traditionalist perspective; Conflict is considered as destructive in traditional management basis and is removed or solve only at high management level. This situation occurred until the 1940s [25]. This aspect held that the interested party would take action whenever there are differences of any magnitude. This is just because of the interested parties are afraid to face any conflict. In our daily routine, either we solve or not try to solve a conflict, it all might be affected by personal habits or other characteristics. But as on same problem or situation, different people will have different opinion and mind of thinking, so it is a normal thing that they will have different reactions to the same situation. But ferocious situation and competitions around, or environment of reconciliation will produce different attitudes in

people to tackle the problems and how to manage the conflict. The traditional way is easily accepted. In general, public thinking is that conflict is not comfortable thing rather a destructive factor in daily life. So, they try to avoid it and due to this factor in many of business world and organizations conflict factor is much reduced by bringing rules and strictly regulated policies. Business management systems such as International Standards for Organisations, Six Sigma System, have working procedure well defined by customer and customer service staff to reduce the grey area in service provision. Behaviourist perspective; Some of the scholars like [33] translated the meaning of conflict through behavioural ways. From the behaviourist, conflict is certain and necessary. One of the reason that why conflict cannot be avoided because different people have different behaviours and we can't decide until and unless both of the opinions are not considered and keep in mind the conflict in issues. So, every kind of conflict cannot be avoided. So, for us regard conflict as positive and natural part of our life. So, for improvement in life, it is necessary to remove and handle conflicts rather than to avoid it. The magnitude of this conflict can be determined from whether or not the conflict should be dealt with or not. Different people have different opinions and remarks about this issue of conflict. If this conflict can be dealt within a level, so it shall be tolerated. So, the interested parties should face even a small conflict to bring organization towards success and improvement. According to some of the behaviourists, conflict factor is natural up to reasonable level. Different people react and act according to their level of capacity, and this level of capacity depends on a person mode of behaviour and judgements. Focus on more critical conflicts can lead the interested parties towards resolution of conflicts in a better way. Also, the direction of the conflict-related behaviour will be clear and easy to identify. Serious and significant conflicts will still be damaging, and so a solution is needed. People must develop conflict management policies to bypass or block any conflict which outpaces their strength level. Behavioralist thinks that minor conflicts are neglectable and reasonable while serious conflicts are negative. Besides and apart from the development of conflict management policies, practitioners not only developed it but also suggested ways to convert major conflicts into minor ones while critical into irrelevant ones. This helps to remove conflicts and to bring it to a level of endurance. Interactionist perspective; In the conflict-survival model, conflict is translated as an attractive relationship between peoples and society. For adaptation, conflict brings changes, so it results in continuity [33]. If the resolution level of achievement is low, the results will be more agreeing.

5. Conclusion

Emotions are considered as a critical factor in conflicts, and it affects the involving party and vice versa [25], the conflict involves threats, then it will increase its response and negative activation too [24]. [25] studied the relationship between the emotional aspects of conflict verdict and cerebral behaviour. [25] found that the level of negative emotionality associated with both relationship and task conflict and affects the group performance [25] However, in the study by [26], a conflict has more favourable performance importance than emotional conflict. People's emotional feedbacks and behavioural reply impact relationship outputs [27]. Variations in relationship conviction and ambiguity are tied to a variety of experiences as conflict [28]. On the other hand, [29] put forth the appraisal theory in which he concludes that people will first review a situation to check out the change of environment and then approaches their intuitive emotions to inspire action linked with those emotions [27] acknowledged that greater relationship comfortably would bring more accommodating and compromising behaviour for tightly attached individuals as compared to those who are observed, boastful and afraid. This shows that emotional intelligence relates to the conflict management styles. Emotion-related behaviour and the complex interaction of emotional intelligence and behavioural responses directly affect the choice of conflict management policy. This interaction not only affects the choice of strategy but also its content conflict management. Choice of conflict management policy will be affected by nature of conflict formation. When knowledge about conflict resolution is not enough, then those who are involved in it may not be capable of the identification of suitable conflict management policy. The elements of the relationship between emotional intelligence and conflict management plan need to be identified for better conflict management. There is much gap that needs to be fulfilled and should need to be addressed about emotional and conflicts and its management.

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An Evaluation of Preprocessing Techniques for Text Classification

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Abstract: Text preprocessing is a vital stage in text classification (TC) particularly and text mining generally. Text preprocessing tools is to reduce multiple forms of the word to one form. In addition, text preprocessing techniques are provided a lot of significance and widely studied in machine learning. The basic phase in text classification involves preprocessing features, extracting relevant features against the features in a database. However, they have a great impact on reducing the time requirement and speed resources needed. The effect of the preprocessing tools on English text classification is an area of research. This paper provides an evaluation study of several preprocessing tools for English text classification. The study includes using the raw text, the tokenization, the stop words, and the stemmed. Two different methods chi-square and TF-IDF with cosine similarity score for feature extraction are used based on BBC English dataset. The Experimental results show that the text preprocessing effect on the feature extraction methods that enhances the performance of English text classification especially for small threshold values.

Keywords: - Text preprocessing, text classification, tokenization, stop words removal, stemming, chi-square, TF-IDF.

1. Introduction

Text classification (TC) is the task in which texts are classified into one or more of predefined classes based on their contents (Kobayashi, et al., 2017). In addition, text classification that means automatic classification of electronic documents in internet and other-fields such as news, article ... etc. TC (also known as text classification or topic spotting) is the task of automatically sorting a set of electronic documents into classes (or categories, or topics) from a predefined set. A topic is simply a collection of words that occur frequently with each other (Sowmya, V., Kiran, K. K. and Putta, 2017). It has an important role to play in the field of natural language processing or other text-based knowledge applications, especially with the recent explosion of readily available text data such as electronic news articles, digital libraries, blogs and Microblogging. Associative text classification, a task that combines the capabilities of association rule mining and classification, is performed in a series of sequential subtasks. They are the preprocessing, the association rule creation, the pruning and the actual classification (Antonie, M. L. and Zaiane, O. R., 2002).

The major objective of text preprocessing is to obtain the key features or key terms from datasets text document and to improve the relevancy between word and document and the relevancy between word and class. It has already been proven that the time spent on preprocessing can take from 50% up to 80% of the entire classification process (Srividhya and Anitha, 2010), which clearly proves the importance of preprocessing in text classification processes.

This paper discuss the types of text preprocessing techniques used in the present research work and analyzes the effect of preprocessing on text classification using machine learning algorithms. Section 2 describes an overview of the work in text preprocessing. Section 3 presents the text preprocessing steps used. Experimental results are included in section 4. Summarization of work narrated in section 5.

2. Related work

The text preprocessing stage of TC is to convert the original textual data to a raw-data structure, where the most significant text-features that serve to distinguish between text-categories are identified. This stage is the most critical and complex process that leads to the representation for each text documents through selection a set of index terms. It is the process of incorporating a new document into an information retrieval system. An effective preprocessor represents the document efficiently in terms of both space (for storing the document) and time (for processing retrieval requests) requirements and maintain good

retrieval performance (precision, recall and accuracy). The main objective of text preprocessing is to obtain the key features or key terms from datasets of text documents and to improve the relevancy between word and document and the relevancy between word and class.

1. In [4], Forman presented an extensive comparative study of feature selection metrics for the high-dimensional domain of TC, focusing on support vector machines and 2-class problems, typically with high class skew. It revealed the surprising performance of a new feature selection metric, Bi-Normal Separation. Another contribution of this paper is a novel evaluation methodology that considers the common problem of trying to select one or two metrics that have the best chances of obtaining the best performance for a given dataset. Somewhat surprisingly, selecting the two best performing metrics can be sub-optimal: when the best metric fails, the other may have correlated failures, as it is the case for information gain (IG) and Chi for maximizing precision.
2. In [5], Debole and Sebastiani proposed supervised term weighting (STW), a term weighting methodology specifically designed for IR applications relating supervised learning, such as TC and text filtering. Supervised term indexing leverages on the training data by weighting a term according to how different its distribution is in the positive and negative training examples. In addition, they present that this should obtain the form of replacing inverse document frequency (IDF) by the category based term evaluation function that has previously been used in the term selection phase; as such, STW is also efficient, since it reuses for weighting purposes the scores already computed for term selection purposes
3. In [6], Soucy and Mineau who propose a new technique (ConfWeight) to weight features in the vector space model for text categorization by leveraging the classification task. So far, the most commonly used method is TF-IDF, which is unsupervised; however, there has been little discussion about TC learning.
4. In [7], Ikonomakis et al. presented that automated TC has been considered as a crucial method to manage and process a vast amount of documents in digital forms that are common and continuously increasing. In general, TC plays an essential role in information extraction and summarization, text retrieval, and question answering.
5. In [8], Kamruzzaman and Haider presented a new methodology for TC that requires fewer documents for training. The researchers used word relation i.e association rules from these words are used to derive feature set from pre-classified text documents.
6. In [9], Shi et al. studied TC, that is an important sub-task in the field of text mining. By considering the frequency, dispersion and concentration concurrently, an enhanced feature selection, feature weighting and term reduction method tackling large set of Chinese texts in the real world is planned. Several studies have produced estimates of TC learning techniques, but there is still insufficient data for this field. Most studies in TC have only been carried out in a small number of areas.

3. Text preprocessing steps

The aim behind text preprocessing is to represent each document as a feature vector that is to split the text into individual words. The text documents are formed as transactions. Choosing the keyword through the feature selection process and the main text preprocessing step is necessary for the indexing of documents. On the other hand, text preprocessing stage after reading the input text documents, it divides the text document to features which are called (tokenization, words, terms or attributes), it represents that text document in a data representation as a vector space whose components are that features and their weights which are obtained by the frequency of each feature in that text document, after that it removes the non-informative features such as (stop words, numbers and special characters). The remaining features are next standardized by reducing them to their root using the stemming process. In spite of the non-informative features removal and the stemming process, the dimensionality of the feature space may still be too high. Therefore; the study applies specific thresholds to reduce the size of the feature space for each input text document based on the frequency of each feature in that text document (Kadhim, A. I., Cheah, Y. N. and Ahamed, N. H., 2014).

3.1 Text documents collection

Text documents collection will be divided into two models: training model and testing model. The former refers to pre-classified set of text documents which is used for training the classifier. On the other hand, training models are identified manually to support different text documents classifiers to make database for each topic, while testing model determines the accuracy of the classifier based on the count of correct and incorrect classifications for each text document in that set which is classified by the classifier into suitable main classes. The training model includes two sets: the first set collects 300 news text documents which were distributed in 10 main categories such as Business, Clothes, Computer, Food, Geography, Medicine, Military, Money and Sport.

3.2 Tokenization

The first step converts HTML files to texts by removing tags from HTML and others tags. Tokenization is commonly understood as any type of natural language text preprocessing. Tokenization is the process of replacing sensitive data, which have a unique identification symbols and it has retained all the essential information about the data without compromising security. Extended Tokenization in our sense does not only separate strings into basic processing units, but also interprets and groups isolated tokens to create higher level tokens. Raw texts are preprocessed and segmented into textual units. The data must be processed in the three operations: the first operation is to convert document to word counts which is equal to bag of word (BOW). The second operation is removing empty sequence i.e. this step comprises cleansing and filtering (e.g., whitespace collapsing, stripping extraneous control characters). Finally, each input text document is segmented into a list of features which are also called (tokens, words, terms or attributes).

3.3 Stop Words Removal

A stop words list is a list of commonly repeated features which emerge in every text document. The common features such as conjunctions such as or, and, but and pronouns he, she, it etc. need to be removed due to it does not have effect and these words add a very little or no value on the classification process (i.e., each feature should be removed when it matches any feature in the stop words list). For the same reason, if the feature is a special character or a number then that feature should be removed. In order to find the stop words, we can arrange our list of terms by frequency and pick the high frequent ones according to their lack of semantics value. They should be removed from words, can also remove very rare words, e.g., words that only occur in m or fewer document, for example $m=6$.

3.4 Stemming

Stemming is the process of removing affixes (prefixes and suffixes) from features i.e. the process derived for reducing inflected (or sometimes derived) words to their stem. The stem need not to be identified to the original morphological root of the word and it is usually sufficiently related through words map to the similar stem. This process is used to reduce the number of features in the feature space and improve the performance of the classifier when the different forms of features are stemmed into a single feature.

For example: (connect, connects, connected, and connecting)

From the mentioned above example, the set of features is conflated into a single feature by removal of the different suffixes -s, -ed, -ing to get the single feature connect.

There are different kinds of the stemming algorithms; some of them can generate incomplete stems which do not have meaning. One of the most common stemming algorithms uses a set of rules to remove suffixes from features, this process continues until none of the rules apply. This algorithm has some drawbacks such as it is not limited to generate feature stems, for example, "retrieval" becomes "retriev". And it does not deal with prefixes completely, so "relevant" and "irrelevant" stay as unrelated features.

The study implements the stemming process by applying a set of rules in specific way. The rules of the stemming process are as follows:

- Remove all prefixes such as pre-, en-, dis-, etc from features, if the prefix exists in features.

- Use a lexicon to find the root for each irregular feature. Where the lexicon has four major irregular tables (irregular verb, irregular noun, irregular adjective and irregular adverb), each table has some fields which represent unify of each feature such as the irregular verb table has (the verb root, past, past participle, present participle and plural) fields. If the feature matches any feature in the fields of the irregular tables thereby feature should be converted to its stem (root) form which exists in the first field of each irregular table.

When the only difference among the similar features in the first characters is (-s, -d, -es, -ed, -ly, -er, -ar, -ing, -ance, -ence, -tion, -sion or any other suffixes), thereby features are conflated under the shortest one among them. Thereafter, the weights of the shortest feature results from summing the frequencies of the conflated features.

3.5 Text Document Representation

Typically, each character in text (object) in the training set is represented as a vector in the form (x, d) , where $x \in R^n$ is a vector of measurements and d is the class label. Each dimension of this space represents a single feature of that vector and its weight which is computed by the frequency of occurrence for each feature in that text document (i.e for the TC, the IR vector space model is frequently used as the data representation of texts). This study will represent each document vector d as $d=(w_1, w_2, \dots, w_n)$.

Where w_i is the weight of i^{th} term of document d . This representation is called data representation or vector space model. In this step, each feature is given an initial weight equal to 1. This weight may increase depend on the frequency of each feature in the input text document (i.e., the similar features in size and characters are conflated under a single feature. The weight of a single feature results from summing the initial frequencies of the conflated features).

These steps mentioned above are used to prepare the text document as depicted in Figure 1.

The pseudo code used for preprocessing explains as below:

For each document in datasets do

Remove tags from HTML files

End for

For each remaining text document in the dataset do

Remove white space and special character

For each remaining text document in the dataset do

Remove stop words

End for

For each remaining word in the dataset do

Perform Stemming using lexical language and store in a vector (Wordlist)

End for

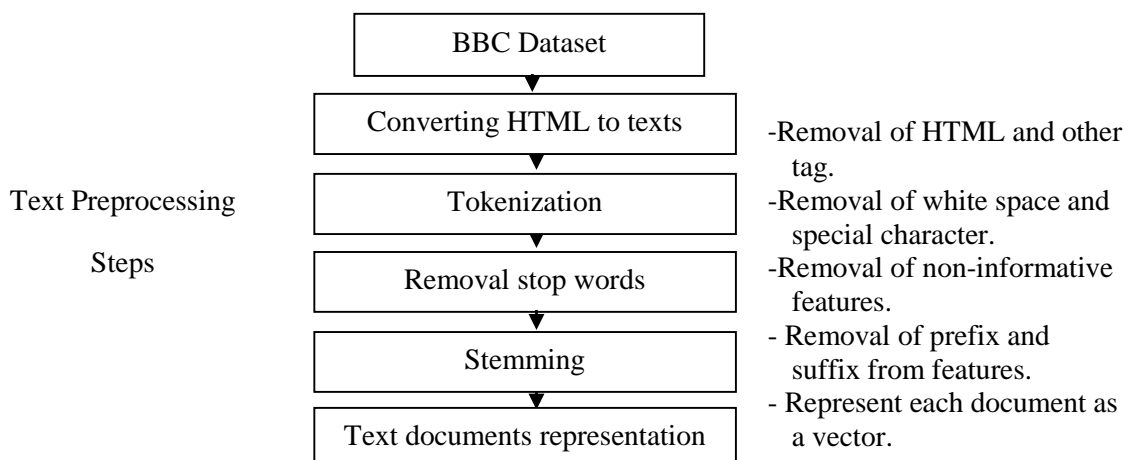


Figure 1. Text preprocessing steps.

3.6 Indexing Techniques

The major objective of document indexing is to increase the efficiency by extracting from the resulting document a selected set of terms to be used for indexing the document. Document indexing involves choosing the suitable set of keywords based on the whole corpus of documents, and assigning weights to those keywords for each particular document, thus transforming each document into a vector of keyword weights. The weight normally is related to the frequency of occurrence of the term in the document and the number of documents that use that term.

3.6.1 Feature extraction using document frequency

Document frequency (DF) is the number of documents in which a term occurs. Document frequency thresholding is the simplest technique for vocabulary reduction. Stop words elimination explained previously, removes all high frequency words that are irrelevant to the classification task, while DF thresholding removes infrequent words. All words that occur in less than 'm' documents of the text collection are not considered as features, where 'm' is a pre-determined threshold and is shown in Equation 1 given by (Alelyani and Liu, 2012). Document frequency thresholding is based on the assumption that infrequent words are non-informative for category prediction. Document frequency thresholding easily scales to a very large corpora and has the advantage of easy implementation. In the present study, during classification, the DF threshold is set as 1 so that terms that appear in only one document are removed. To compute "m" value by using chi-square equation below:

$$x^2(t, c) = \sum_{i=1}^N \sum_{j=1}^M \frac{(P_{t,c} - N_{t,c})^2}{N_{t,c}} \quad (1)$$

Where t is the term in text document, c is the class, N is the number of text document, M is the number of classes, $P_{t,c}$ is the correct term belong to each class, and $N_{t,c}$ is the incorrect term not belong to each class. Figure 2 shows the flowchart of document frequency steps.

Chi-square is a measure of how many term correct counts $P_{t,c}$ and incorrect term counts $N_{t,c}$ deviate from each other. The score can be globalized over all classes in two ways:

1. The first way is to compute the weighted average score all classes.
2. The second way is to choose the maximum score among all classes.

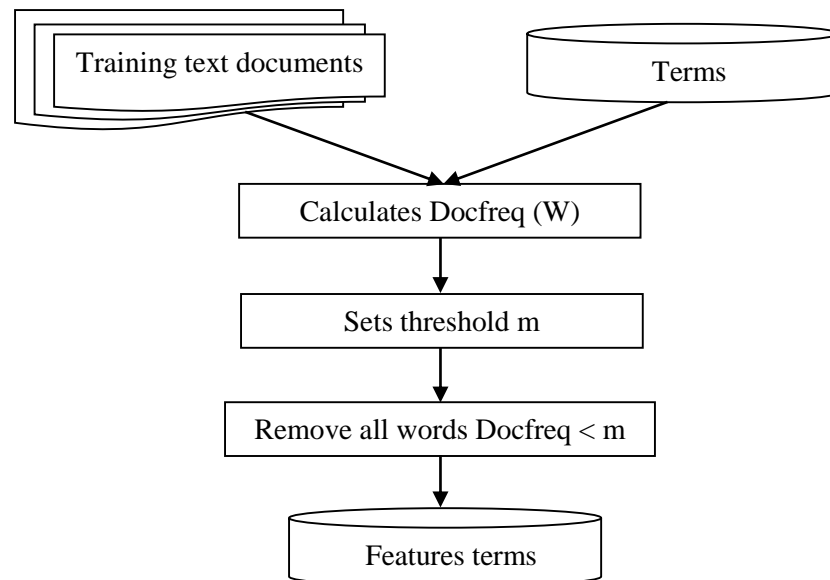


Figure 2. Flowchart of DF steps.

The pseudo code used for DF explains as follows:

For each text document in datasets do

```

Remove tags from HTML files
End for
For each remaining text document in the dataset do
Remove white space and special character
For each remaining text document in the dataset do
Remove stop words
End for
For each remaining word in the dataset do
Perform Stemming using lexical language and store in a vector (Wordlist)
End for
For each word in the Wordlist do
Calculate chi-square and store the result in a weight matrix
End for
For each element in weight matrix
Set the threshold 'm'
Calculate DF for each term
If DF < m then
Remove the term along with its weight from weight matrix
End if
End for

```

3.6.3 Feature extraction using TF-IDF (term weighting)

Term weighting can be as simple as binary representation or as detailed as a mix of term and dataset existence probabilities stemmed from complex information theoretic underlying concepts. Method like term frequency-relevance frequency (TFRF) express that it is better to award the terms with the highest frequencies in the positive category and penalize the terms with the highest frequencies in the negative category. More or less, TF/IDF is the most widely known and used weighting method, and it is remain even comparable with novel methods. The aim behind text preprocessing stage is to represent each document as a feature vector that is to separate the text into individual words. In TF-IDF terms weighting, the text documents are modeled as transactions. Selecting the keyword for the feature selection process is the main preprocessing step necessary for the indexing of documents. This study used TF-IDF to weight the terms in term-document matrices of our evaluation datasets, given a document collection 'D', a word 'w', and an individual document d. D, the weight w is calculated using Equation 2 and 3 given by (Ramya, M., & Pinakas, A., 2014) as follows

$$TF = TF \times IDF \quad (2)$$

$$w_d = f_{w,d} \times \log \frac{|D|}{f_{w,D}} \quad (3)$$

where $f_{w,d}$ or TF is the number of times 'w' appears in a document 'd', $|D|$ is the size of the dataset, $f_{w,D}$ or IDF is the number of documents in which 'w' appears in D. The result of TF-IDF is a vector with the various terms along with their term weight.

3.6.4 Cosine Similarity Measure

In this study, the researcher used the cosine similarity function between a pair of text documents depends upon the word frequency and number of common words in both text documents. A longer document has higher word frequencies and higher number of unique words than shorter documents producing higher similarity to user queries than shorter documents. So the cosine similarity values of two text documents in the training dataset are found. The cosine similarity between a query vector $\vec{q} = (q_{11}, q_{12}, \dots, q_{1N1}, q_{1n2}, \dots, q_{mNm})$ and a text document vector $\vec{d} = (d_{11}, d_{12}, \dots, d_{1N1}, d_{1n2}, \dots, d_{mNm})$ is computed in Equation 4 given by (Mao and Chu, 2007) as follows:

$$sim(q, d) = \frac{\vec{q} \cdot \vec{d}}{|\vec{q}| \times |\vec{d}|} = \frac{\sum_{i=1}^m \sum_{j=1}^{N_i} q_{ij} \times d_{ij}}{\sqrt{\sum_{i=1}^m \sum_{j=1}^{N_i} q_{ij}^2} \times \sqrt{\sum_{i=1}^m \sum_{j=1}^{N_i} d_{ij}^2}} \quad (4)$$

Where $|\vec{q}|$ and $|\vec{d}|$ are the norms of the document vectors, q_i is the TF-IDF weight of term i in the query, d_i is the TF/IDF weight of term i in the document, m is the number of document in the features set, and N_i is the number of the terms belong to document i in the features set. Since $q_{ij} \geq 0$ and $d_{ij} \geq 0$, (q, d) varies from zero to +1 and shows the degree of similarity between a query q and a text documents d . If the similarity between a query and a text document is greater than a predefined threshold value then the text document is the best in features set; otherwise repeat until to all features set.

The pseudo code for the calculation of TF-IDF is depicted as follows:

```

For each text document in Twitter datasets do
  Remove tags from HTML files
End for
For each remaining text document in the dataset do
  Remove white space and special character
  For each remaining text document in the dataset do
    Remove stop words
  End for
  For each remaining word in the dataset do
    Perform Stemming using lexical language and store in a vector (Wordlist)
  End for
  For each word in the Wordlist do
    Determine TF, calculate its corresponding weight and store it in
    Weight matrix (WD)
  End for
  Determine IDF
  If IDF = zero then
    Remove the word from the Wordlist
    Remove the corresponding TF from the WD
  Else
    Calculate TF-IDF and store normalized TF-IDF in the corresponding element of the weight
    matrix
  End if
  Calculate the similarity function
  Set the threshold "n"
  If TF-IDF < "n"
    Remove the term along with its weight from weight matrix
  End if
End for

```

4. Experimental results

4.1 Datasets

There are three datasets are used in this paper which is:

- **BBC English Dataset (BBC English)** is an English dataset collected manually from BBC online newspaper. The dataset consists of 4470 articles published from 2012 to 2013. Since there is no standard to split the document this dataset for training and testing, cross validation is performed. Ten random chosen splits were constructed such that the training documents in each split represent fifty of the total number of documents.

4.2 Performance evaluation

A chosen text documents sets are divided into training set and testing set. The training set is used to identify word, which are then used to recast all text documents in the set as bags of words. The accuracy of text documents of the resulting is performed by using tenfold cross-validation.

Initial experiments examined the three methods outlined above for defining key phrases (features); the selection of values for the Boolean weighting, document frequency and TF-IDF with the sets threshold (n) for cosine similarity score and variations in the support and chi-square thresholds (m) used in the application of the documents frequency algorithm.

Each word in the class is used as a classifier to classify both positive and negative text documents in the training dataset. To determine the chi-square function of a word the researcher uses predictive accuracy (Kastrin, A., Peterlin, B., & Hristovski, D., 2010) which is defined as:

$$Accuracy = \frac{TP + TN}{TP + FP + FN + TN} \quad (5)$$

According to Table 1, true positive (TP) the number of text document correctly assigned to this category, true negative (TN) the number of text document incorrectly assigned to this category, false positive (FP) the number of text document incorrectly assigned to this category, false negative (FN) the number of text document correctly rejected assigned to this category (Zhang, W., Yoshida, T., & Tang, X., 2011). These terms are used to compute the precision (P), the recall (R), and the F1-measure as follows:

$$Precision(P) = \frac{TP}{TP + FP} \quad (6)$$

$$Recall(R) = \frac{TP}{TP + FN} \quad (7)$$

$$F1 - measure = \frac{2 \times P_i \times R_i}{(P_i + R_i)} \quad (8)$$

Table 1. The contingency matrix for a 2-class classification metrics.

Actual category	Predicted category	
	Classified positive	Classified negative
Actual positive	TP	FN
Actual negative	FP	TN

The precision, recall, accuracy and F1-meseasure are shown in the Table 2 for each category by using the two different methods.

Table 2. Performance evaluation for the chi-square and TF-IDF with cosine similarity score methods.

category	Chi-square				TF-IDF			
	Acc.	P		Acc.	P		Acc.	P
Business	70.00	75.00	85.71	80.00	82.00	90.00	87.80	88.89
Clothes	70.00	78.21	82.43	80.26	82.00	91.03	86.59	88.75
Computer	66.00	72.94	84.93	78.48	80.00	89.41	87.36	88.37
Food	70.00	74.12	88.73	80.77	78.00	83.53	89.87	86.59

Geography	63.00	71.43	82.19	76.43	77.00	88.10	85.06	86.55
Medicine	73.00	79.01	86.49	82.58	83.00	91.36	88.10	89.70
Military	72.00	73.26	92.65	81.82	85.00	88.37	93.83	91.02
Money	75.00	80.23	89.61	84.66	83.00	89.53	90.59	90.06
Sport	67.00	74.70	83.78	78.98	77.00	86.75	85.71	86.23
Industry	69.00	78.21	81.33	79.74	82.00	91.36	87.06	89.16
Avg.	69.50	75.71	85.79	80.37	80.90	88.94	88.20	88.53
STDEV	3.50	2.98	3.65	2.29	2.77	2.42	2.60	1.62

Note: Acc.= accuracy, P=precision, R=recall and F1=F-measure.

The performance evaluation of chi-square and TF-IDF with cosine similarity score methods for each category as shown in Figure 3.

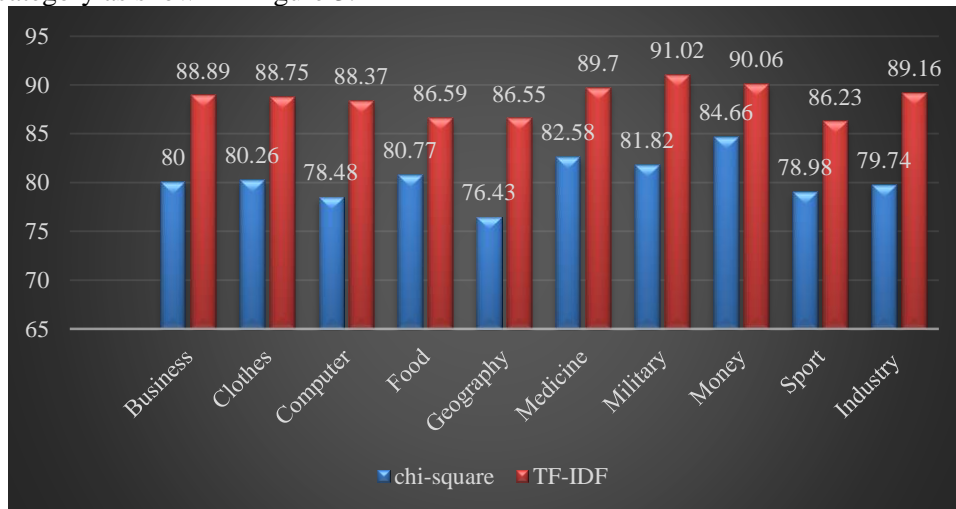


Figure 3. Comparison between chi-square and TF-IDF with cosine similarity score with respect to F1-measure.

The proposed system technique for classifying texts can be classified into one or more topics based on their contents. Figure 4 shows the performance comparison graph between chi-square and TF-IDF with cosine similarity score methods with respect to F1-measure. Blue color indicates F1-measure of chi-square while red color indicates F1-measure of TF-IDF with cosine similarity score method.

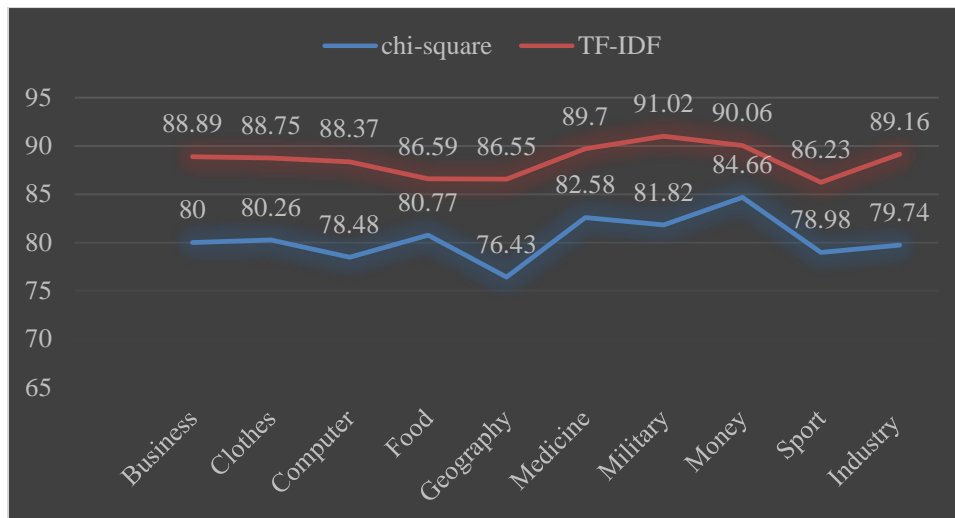


Figure 4. The performance comparison graph between the chi-square and TF-IDF with cosine similarity score methods with respect to F1-measure.

Overall, TF-IDF with cosine similarity score performed better for all categories based on F1-measure.

5. Conclusion:

The paper presents comparing between chi-square and TF-IDF with cosine similarity score methods to classify texts in one or more based on their contents. The proposed system can be used text preprocessing, feature extraction based on the thresholding parameter to classify the texts into one or more categories. TF-IDF with cosine similarity score performed better in classifying the ten general categories based on evaluation metrics. The results showed that text preprocessing can improve the recognition degree of texts and the system performance for text classification.

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Kalman Filter As A Threshold In Estimating The Level Of Fatigue Based On Eyelid Movement

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Abstract—Using technology to build human comforts and automation is growing rapidly possibly because of dynamic nature of the world now, particularly in most industrial setups. Hence, the Human fatigue detection based on vision be said to be the most promising commercial applications of Human Computer Interface. Nevertheless, this area has some limitations which include fast movement of the head and eyes, external illuminations interference and realistic lighting conditions. In this paper, a new algorithm for detecting human fatigue by relying primarily on eyelid movements as a facial feature is proposed. The movement or velocity of the eyelid is tracked using a Kalman filtered velocity function. Unlike existing methods that employ similar strategies for eye movement analysis, the new algorithm developed, calculates a human blink cycle for each individual, and estimates the associated errors of the eye movement due to friction using the Kalman filter. The proposed system which has been employed on a number of diverse videos, averagely has a 93.18% accuracy detection rate out of a total of 35000 image frames. The distinction in the proposed method is due to its low error rate and quick processing of input data. The paper has therefore established human blink cycle calculation as a new classifier to characterize human fatigue and the calculation of the movement of eyelid using the Kalman filter in determining the level of fatigue.

Index Terms—Kalman filter, fatigue, Human Computer Interface, blink cycle, eyelid velocity

I. INTRODUCTION

According to the Journal of Applied Physiology, fatigue is a feeling of continuous tiredness or weakness and which can be either physical, mental or a combination of both. At a point in life, most adults will experience fatigue but it can literally affect anyone. Fatigue is a symptom, not a condition. Fatigue is initiated by either lifestyle, social, psychological or general wellbeing issues instead of an underlying medical condition for most people.

Fatigue even though referred to as tiredness is very much not the same as just being or feeling tired, sleepy, or drowsy. Everyone eventually feels tired, but is most of the time relieved with a nap or a few hours of sound sleep. It is also likely for a person feeling sleepy to feel momentarily refreshed after exercising. A person who finds it difficult to engage in normal activities, focus or be inspired at normal levels even though is getting enough sleep, has good nutrition and exercises regularly may be experiencing fatigue and may need medical attention.

In Computer Vision, visual analysis of human activities is among the actively and widely studied subjects [1]. This has resulted numerous promising applications in many research areas such as Virtual reality, Perceptual interface, Motion-based diagnosis and Smart surveillance [2]. Fatigue is a symptom, rather than a sign in the field of medicine. A patient description of his feelings is a symptom such as a headache or dizziness, while a sign is instantaneously detected by a medical practitioner without consulting the patient. Fatigue being non-specific symptom may have different probable causes. Any activity that requires intense visual concentration such as extended amounts of driving or reading can cause fatigue.

Previous authors have identified several approaches to Fatigue and drowsiness monitoring systems with sensor based techniques [3]. However, such have been known to possess some inherent disadvantages over vision-based techniques. For example, the sensor fusion based system by Sahayadhas [4] and by Elena et al. [5] used multiple sensors to study drivers' drowsiness and fatigue. The sensors were fixed to the upper quarter of the body of drivers and thus impeded their driving processes. Experiments conducted on them showed poor detection rates.

Furthermore, the sensor based approach is highly hardware dependent and the apparatus is not easy to setup. Therefore, a surveillance system based on

visual analysis techniques has been regarded as a better solution for monitoring fatigue [6]. Other researchers have devoted their work to developing fatigue detection systems using machine vision techniques [7]. Many early researches are only centered on the analysis of the pupil movements. These systems used infrared cameras based on the “red eye effect” to help track the pupils. Although an infrared camera can capture clear images in dark environments, it usually loses most of its features under sufficient lighting environments especially under very bright illumination [8]. This has affected and reduced the accuracy of the infrared approaches with enough illumination. Previous research [9] has shown that fatigue related traffic accidents occur mainly during morning hours and mid-afternoon lunch time hours. These crash peaks are at times when there is enough natural illumination, and so they seriously decrease the accuracy of infrared devices. They also prove that the infrared approaches are not reliable for fatigue detection.

Currently most studies have tried to characterize fatigue based on the eye using mainly the pupil and the iris. These features cannot easily be extracted as the full cooperation of the individual is required. Computing information on the iris is subjective if the prior information of the individual is not known as this depends on race [10]. These methods therefore tend to be impractical especially when the individual’s awareness is not needed. The general objective is designing and developing a prototype that detects fatigue based on blinking the eye or movement of the eyelid.

II. LITERATURE REVIEW

A. The Kalman Filter

The Kalman Filter has for a long time been viewed as the ideal solution to many tracking and data prediction problems. It has been well and frequently documented by many researchers in the analysis of visual motion [11]. The Kalman Filter has been used positively in a variety of predictions and state determination application systems.

In 1958, Rudolph Kalman develops the Kalman filter although a very similar algorithm by Peter Swerling. The filter was named after Kalman due to the following reasons. He published his research in a more prominent and prestigious journal and also his work was hailed to be more general and complete [12].

Kalman-Bucy filter is another name given to this filter due to an earlier jointly conducted work between Richard Bucy and Kalman.

The genesis of this algorithm traces all the way back to the method of least squares by 18-year old Karl Gauss’s in 1795. The Kalman filter was developed to solve the problem of spacecraft

navigation for the Apollo space program. It has since then been found in applications in hundreds of different areas, including various forms of navigation (aerospace, land, and marine), nuclear power plant instrumentation, demographic modelling, manufacturing, detection of underground radioactivity, and fuzzy logic and neural network training.

Object tracking is one significant area of application in computer vision. Activities like changing moving conditions and occlusions can impede the vision tracking of an object. The Kalman Filter (KF) is one of the most appropriate models for object tracking. This chapter discusses the application of the Kalman Filter in fatigue characterization and prediction.

The Kalman filter even though over 50 years old is still one of the most important and common data fusion algorithms in use today. The great achievement gained by the Kalman filter is due to these desirable properties i.e. its small computational requirement, elegant recursive properties, and its status as the optimal estimator for one-dimensional linear systems with Gaussian error statistics.

The Kalman filter allows the estimation of variables for a large number of processes. Mathematically, the Kalman filter estimates the states of a linear system. The Kalman filter is attractive both theoretical and in practice because it works well in both sense. In minimizing the variance of the estimation error, the Kalman filter has been proven to be the best as compared to other filters. The Kalman filter is often executed in embedded control systems, due to its ability to control a process when there is prior need for an accurate estimate of the process’ variables.

The Kalman filter contains a set of mathematical equations that gives an efficient computational (recursive) means to approximate the state of a process that is assumed to be propagated by a Gaussian distribution, in a way that reduces the mean of the squared error.

The Kalman filter offers a recursive statistical framework for the estimation and prediction of the state of a process, given a mathematical model of that process. In the case of eye movements, this framework provides the ability to predict future gaze position, given the values of the state of the eye movement signal, as well as to smooth the signal by attenuating noise in the form of measurement and estimation error. In other words, the Kalman Filter by minimizing the mean of the squared estimate error estimates the process state.

The most common uses of the Kalman filter include smoothing out noisy data and providing estimates of parameters of interest.

K.F applications include global positioning system receivers, phase-locked loops in radio equipment,

smoothing the output from laptop track pads, and many more.

From a theoretical point of view, the Kalman filter is an algorithm that permits exact inference in a linear dynamical system, which is a Bayesian model similar to a hidden Markov model. However, with the K.F, the state space of the latent variables is continuous when all latent and observed variables have a Gaussian distribution (often a multivariate Gaussian distribution).

The Kalman filter is usually derived by using vector algebra as a minimum mean squared estimator. The Kalman filter is obtained from first principles by manipulating a key property of the Gaussian distribution which states that the multiplication of two Gaussian distributions gives another Gaussian distribution.

B. The Kalman filter theory and algorithm

Kalman filter, also referred to as linear quadratic estimation (LQE), is a sequential method that uses a series of measurements over a period of time, containing statistical noise and other inaccuracies, and produces estimates of unknown variables that are inclined to be more accurate than those based on a single measurement alone. The KF is an algorithm that estimates the state of a system given equations for the time evolution of the system and noisy measurements of quantities related to the state variables [13], [14]. The KF is made up of two steps and processes data in a sequentially manner. The first step is the prediction step and the second is the update step. The prediction step requires knowledge of the evolution of the state and the update step make use of data (if available) to improve the estimate of the state x and its error covariance.

A few questions have to be dealt with in order to calculate the state of a linear system using the described state equations and current measurements without disrupting the consistent behavioral ways of the system. How does one best estimate the state of the system, how can a correct estimate of the true state be directly measured, and what criteria should the estimator satisfy? In order to attempt to answer the above questions, some requirements are to be met. The first being, both the average value of the state estimator and the true state of the system must be equal. The importance of this is because there should not be any bias in the estimate. Mathematically, the expected value of the estimate should be the same as the expected value of the state.

The second requirement might be; a state estimate must vary from the true state as little as possible. That is, not only does the average of the state estimate need to be equal to the average of the true state but also there is the need for a smallest possible variation of the state estimate. Mathematically, this can be considered as finding

an estimator with the smallest possible variance in error. In light of the above stated criteria, only the Kalman filter satisfies the requirement for the two standards. Nevertheless, particular assumption about the noise that affects the systems must be properly satisfied before the Kalman filter solution cannot be applied.

C. The Role of Kalman Filter in This Work

The Kalman filter is analysed in the environment of multi-modal eye detection and eyelid movement using data from captured videos or image sequences. The Kalman filter is shown to be suitable for real-time non-stationary classifier fusion. The available sequential uni-modal and multi-modal decisions combined does not only also bring about a consistent continuous stream of decisions, but also leads to substantial improvements when compared to the input decision performance.

The focal point in the research field of human-machine interaction and computer vision in recent years has been on eye tracking due to the fact that it plays significant role in many applications. Eye tracking becomes difficult due to many factors including lighting, gesture and covering objects. There are a number of computational methods that can be used to solve tracking parameters according to Xu and Lee [15].

The Kalman filtering process has the following advantages;

- It is recursive in nature, computationally efficient and does not need large amount of storage for the past samples.
- The information about the system and measurement noise is stored in its model,
- It deals with time varying signals effectively.
- The current states are estimated by the results of the previous step
- The estimation's accuracy can be ascertained by observing the error covariance.

The Kalman filter is employed as a combiner for temporally ordered classifier decisions in this study. According to Glodek et al [16], combining classifier decisions is a well-known approach to enhance classification performance. Although more and more classifier systems are implemented in real-time applications, the area of non-stationary fusion of decisions is still a research topic which little attention is paid to. The Kalman filter built on a Markov model is a linear dynamical system capable of merging a variable number of measurements (decisions), and in a unified framework deals with sensor failures.

D. Related Works

A summary of face monitoring systems for detection and tracking of face, eye and other

components of face and comparison between them is presented below [17].

- Ji and Yang [18] conducted another research in this area of study using Probability theory (Bayesian network). The tracking method used was based on Adaptive filters (Kalman filter) focusing on eye blink speed, gaze direction and head rotation
- Dong and Wu's [19] work on fatigue detection was based on gaze direction and eye saccadic movement. The tracking method used was the combination of Kalman filter and mean shift algorithm.
- Zhang and Zhang [20] used the Learning-based (using Viola- Jones method) based on Adaptive filters (KF) using the continuous eye closure
- Batista [21] did some work in this area of study using the eye detection based on RGB color space. Here the tracking method was the adaptive filters (Kalman filter) using the head rotation.
- In 2009, Sigari [22] also conducted another research which on learning based using Viola-Jones method. The tracking method used was also based on template matching using the distance between the eyelids.
- Flores et.al [23] used the same Voila-Jones method but the tracking was on other algorithm in conjunction with neural networks based on eye blink rate using the Head orientation.
- Sigari et.al [24] improved on the Viola -Jones method by explicitly using feature- based projection and the tracking was done using face template matching.

III. METHODOLOGY

In tracking the eyelid movement, the Kalman filter is employed and in order to predict the state of the eyelid the movement of the eyelid is considered as a linear system. The following steps was adopted:

1. Fit problem definition into the Kalman filtering condition as stated in the following two equations [25].
$$X_k = W_{k-1} + BU_k + AX_{k-1} \quad (1)$$

$$Z_k = V_k + HX_k \quad (2)$$
2. Define the required parameters and the preliminary values that will work with the model. In doing this, there are two distinct set of equations to be considered, namely the Time update (prediction) equations and the Measurement update (correction) equations. Both of these equations can be applied at any k^{th} state of the process.
3. Iterate through the estimate where previous estimates become the input for the current state [26]. This process is as presented below:

- a. Project the state ahead (Where do we end up)

$$L_{\text{predicted}} = Du_n + CL_{n-1} \quad (3)$$

- b. Project the error covariance ahead (When we get there, how much error)

$$W_{\text{predicted}} = F + CW_{n-1}C^T \quad (4)$$

- c. Innovation (Compare reality to prediction)

$$\tilde{y} = -Vx_{\text{predicted}} + Z_n \quad (5)$$

- d. Innovation Covariance (Compare real error to predicted error)

$$S = G + VW_{\text{predicted}}V^T \quad (6)$$

- e. Compute the Kalman Gain (What do you trust more)

$$K = W_{\text{predicted}}V^TS^{-1} \quad (7)$$

- f. Update the estimate (New estimate of where you are)

$$L_n = K\tilde{y} + X_{\text{predicted}} \quad (8)$$

- g. Update the error covariance (New estimate of error)

$$W_n = (I - KV)W_{\text{predicted}} \quad (9)$$

- h. If the updated error covariance is not acceptable, go to step a

Where

- Inputs:
 U_n = Control vector. This shows the magnitude of any control system's or user's control on the situation.
 Z_n = Measurement vector. This contains the real world measurement we received in this time step.
- Outputs:
 L_n = Newest estimate of the current "true" state.
 W_n = Newest estimate of the average error for each part of the state.
- Constants:
 C = State transition matrix. Basically, multiply state by this and add control factors, and you get a prediction of the state for the next time step.
 D = Control matrix. This is used to define linear equations for any control factors.
 V = Observation matrix. Multiply a state vector by V to translate it to a measurement vector.
 F = Estimated process error covariance. Finding precise values for F and G are beyond the scope of this guide.
 G = Estimated measurement error covariance. Finding precise values for F and G are beyond the scope of this guide.

It is worth noting that the sequences W_n , and K_n are not dependent on the measurements.

Therefore, the sequences W_n and K_n can be pre-computed before any measurements are taken. Of course, these quantities can also be computed in real-time if desired.

IV. EXPERIMENTAL RESULTS ANALYSIS

A. Eyelid Tracking Using Kalman Filter

Tracking the eyelid has been done using the Kalman Filter. Tracking of the eyelid can be done by extracting frames from the sample videos. From the individual frames, the object of interest is selected for tracking by setting the position of the mask in the initial frame. This position of the object is then used for tracking in subsequent frames. The object's distance is determined by using the centroid position of the mask. The pixel positions of the moving object from the initial stage to the final stage of tracking were used in calculating the distance covered by the said object. The velocity of the moving objects is calculated by the distance it travelled with respect to time. Table 1 shows the velocity of the moving eyelid for the seventy (70) sample videos taken for the analysis analysis and Figure 1 shows the graphical form of the moving eyelid velocity. Detailed results are found in Appendix A.

Table 1 Moving Eyelid Velocity

Sample	Velocity
1	1.213351648213
2	1.130019665512
3	1.410476672776
4	1.410476672776
5	1.280733296896

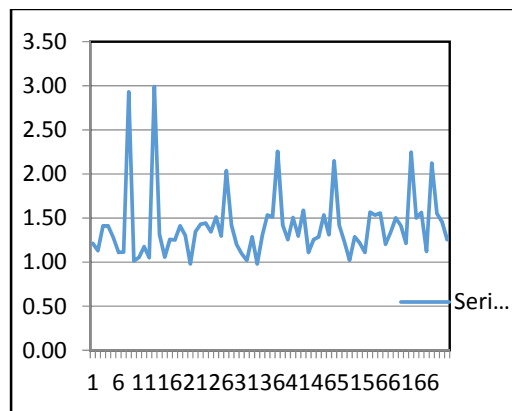


Figure 1 Moving Eyelid Velocity Graph

B. Eyelid State Prediction Analysis Using Kalman Filter

The eyelid's state is estimate using the Kalman filter which is useful in smoothing out noisy data and giving estimations of parameters of interest.

The value of the current state is determined by the prediction state equations of the Kalman Filter determine using values from the previous state. Using the velocity data gathered from the previous section as inputs to the Kalman Filter, the state of the eyelid can be determined at any given time. Data gathered from two different people captured under the two main conditions are used (fatigue and active conditions). The Kalman Filter is applied on the relative velocities of the video samples as shown in Table 2 and Table 3. Video index 10 which shows the active mood and 64 showing the fatigue mood are used in Table 2(Sample I) and Video Index 25 and 65 are shown in Table 2 (Sample II). Detailed results found in Appendix B and Appendix C of Table 2 and Table 3 respectively. The graphs of these analysis are shown in Figure 2 and Figure 3. The number of cycles found in each video sequence can be found in Appendix D.

Table 2 State Prediction Analysis Sample I(a)

Fatigue Mood		
Cycles	Current	Predicted
1	6.833841	6.766180318
2	6.833841	6.799859647
3	7.970441	7.189410294
4	5.571892	6.784620774
5	6.85846	6.799447709

Table 2 State Prediction Analysis Sample I(b)

Active Mood		
Cycles	current	Update
1	6.063839	6.003801
2	6.065018	6.034273
3	6.010617	6.026401
4	6.059348	6.034646
5	7.095578	6.247682

Table 3 State Prediction Analysis Sample II(a)

Fatigue Mood		
Cycles	current	update
1	6.111919	6.051406
2	6.04394	6.047689
3	6.028952	6.041454
4	6.95656	6.270463
5	6.95656	6.408232

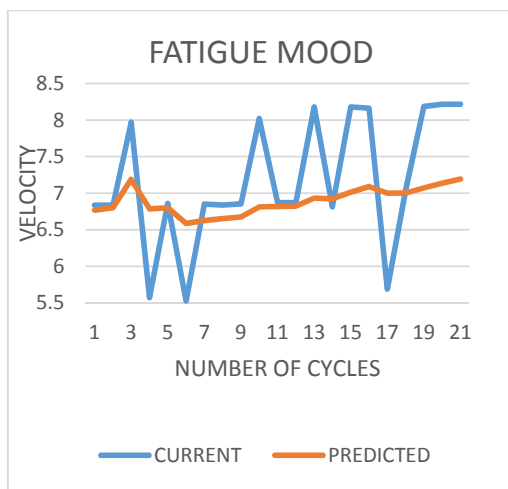


Figure 2 Fatigue mood state prediction (a)

Active Mood		
Cycles	Current	Predicted
1	7.816684	7.739292
2	7.816684	7.777815
3	7.853679	7.803062
4	5.145802	7.138074
5	7.87913	7.286879

Table 3 State Prediction Analysis Sample II(b)

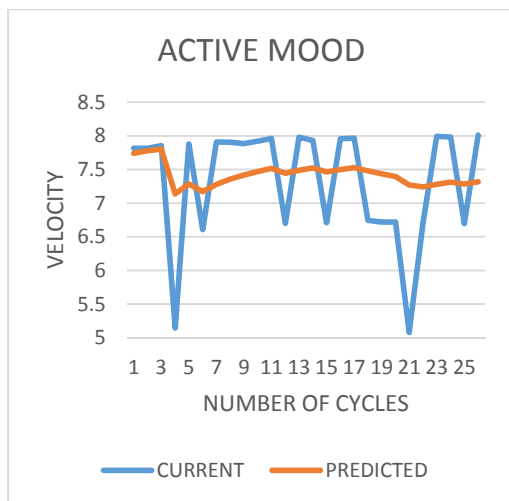


Figure 2 Active mood state prediction (b)

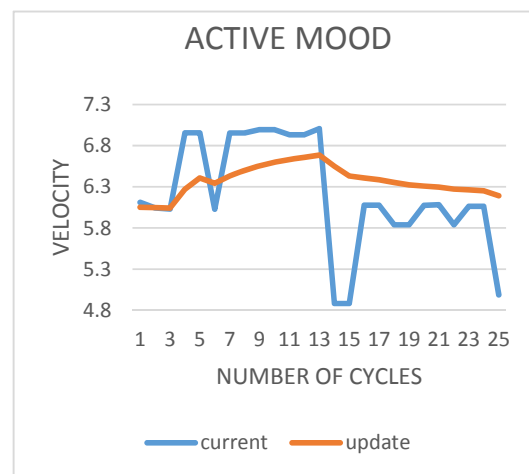


Figure 3 Active mood state prediction (a)

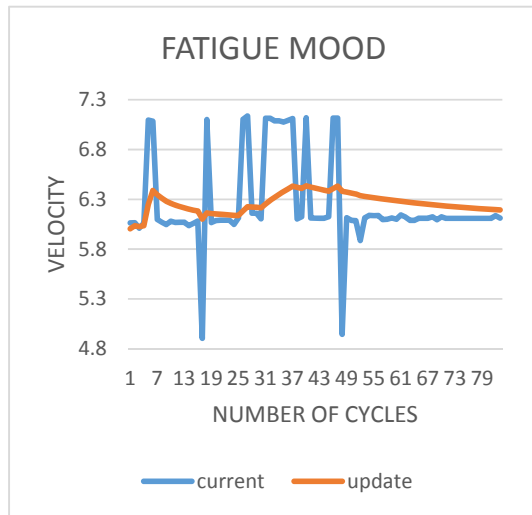


Figure 3 Fatigue mood state prediction (b)

The data gathered shows two different people captured under the two main conditions. After the analysis of the captured data representing the velocity of the eyelid movement using Kalman filter, it can be confirmed that a graph representing the person in the active state has most of the peaks below the Kalman line (update).

However, the situation where most of the peaks of the velocity (current) from the graph fall above the Kalman line indicates that the person is in fatigue stage and have a lower eye blink rate.

On the other hand, if the current velocity at any given time is the same as the estimated velocity at the same time, then the person is in normal state. From the above analysis, the following three states of fatigue characterization, which is defined by the frequent blinking and long durations of eye closure, are presented in Table 4 below:

Table 4 Fatigue Characterisation

Characterization	Description
Active	If greater proportion of current velocity is less than the estimated velocity at a specific time range. It means that most of the cycles detected are below the Kalman line.
Normal	If the current velocity at time t and the estimated velocity at the same time t are the equal.
Fatigue	If greater proportion of current velocity is greater than the estimated velocity at

a specific time range.

V. CONCLUSION

Fatigue was detected in 39 of the seventy samples resulting in 55.7%. The duration of the video clips were considered by counting the number of closed and opened eyes within the continuous frames [27]. Closed and opened eyes were detected in adverse conditions such as with and without eye glasses and also under different hair styles. This outcome was generated using the Kalman Filter.

This work can be used to reinforce the development of smart surveillance systems which can be used on our roads by the national road safety commission in Ghana to curb down fatigue related accidents. Furthermore, it can also be used in the development of other hyper-vigilance systems and security related systems in industrial and other social work areas.

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Various Light Conditions” ,Proceedings of the 2002 IEEE Intelligent Vehicle Symposium pp 344-351

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APPENDIX A
MOVING EYELID VELOCITY

Sample	Velocity
1	1.213351648
2	1.130019666
3	1.410476673
4	1.410476673
5	1.280733297
6	1.110055054
7	1.114051664
8	2.929753006
9	1.013354565
10	1.054092553
11	1.174260997
12	1.050132267
13	2.989332887
14	1.314555269
15	1.056855924
16	1.257532858
17	1.251221625
18	1.409984239
19	1.303947
20	0.97993764
21	1.345155918
22	1.430034965
23	1.443471895
24	1.344329655
25	1.511621646
26	1.296683805
27	2.03749574
28	1.41911553
29	1.20011415
30	1.096120401
31	1.018879032
32	1.286683938
33	0.97993764
34	1.303947
35	1.533645659

36	1.511621646
37	2.254587446
38	1.41911553
39	1.254887849
40	1.503958999
41	1.296683805
42	1.586644789
43	1.110055054
44	1.255489665
45	1.286683938
46	1.533645659
47	1.311621646
48	2.148554453
49	1.41911553
50	1.225447789
51	1.021554444
52	1.286683938
53	1.215486633
54	1.110021114
55	1.565022455
56	1.533024579
57	1.555455488
58	1.202254874
59	1.338954475
60	1.501442553
61	1.411854478
62	1.214885458
63	2.245874589
64	1.501486236
65	1.562211404
66	1.122458888
67	2.122255541
68	1.552215545
69	1.45893632
70	1.254887788

APPENDIX B
STATE PREDICTION ANALYSIS 1

Active Mood		
Cycles	Current	Predicted
1	7.816684	7.73929
2	7.816684	7.77782
3	7.853679	7.80306
4	5.145802	7.13807
5	7.87913	7.28688
6	6.60734	7.17277
7	7.906723	7.27883
8	7.904587	7.35832
9	7.885993	7.41821
10	7.920657	7.46983
11	7.962316	7.51611
12	6.698766	7.44521
13	7.980749	7.48841
14	7.931756	7.52188
15	6.708882	7.46411
16	7.95764	7.49728
17	7.966885	7.52727
18	6.743412	7.47953
19	6.720667	7.43528
20	6.720641	7.39528
21	5.077449	7.27032
22	6.708908	7.2411
23	7.992077	7.27893
24	7.98052	7.31322
25	6.696346	7.28392

26	8.010843	7.31754
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Fatigue Mood		
Cycles	Current	Predicted
1	6.83384	6.76618
2	6.83384	6.79986
3	7.97044	7.18941
4	5.57189	6.78462
5	6.85846	6.79945
6	5.52626	6.58566
7	6.85177	6.62412
8	6.83672	6.65112
9	6.85339	6.67408
10	8.01888	6.81223
11	6.86855	6.81752
12	6.86855	6.82195
13	8.17878	6.9314
14	6.81224	6.9224
15	8.17847	7.01166
16	8.16105	7.08892
17	5.68796	6.99946
18	7.03335	7.00152
19	8.18507	7.07052
20	8.21588	7.13464
21	8.21588	7.19293

APPENDIX C
STATE PREDICTION ANALYSIS I

Active Mood					
Cycles	current	update			
1	6.063839	6.0038	36	7.093238	6.40577
2	6.065018	6.03427	37	7.111737	6.4325
3	6.010617	6.0264	38	6.103187	6.42018
4	6.059348	6.03465	39	6.124722	6.40925
5	7.095578	6.24768	40	7.118559	6.43521
6	7.084029	6.38812	41	6.112937	6.42353
7	6.096743	6.34601	42	6.111014	6.41231
8	6.069973	6.31095	43	6.111014	6.40159
9	6.046369	6.28092	44	6.111014	6.39133
10	6.080719	6.26035	45	6.124722	6.382
11	6.06796	6.24227	46	7.116328	6.40753
12	6.068934	6.22724	47	7.116328	6.43201
13	6.068934	6.21447	48	4.944773	6.38097
14	6.035877	6.20098	49	6.114845	6.37189
15	6.059298	6.19091	50	6.089444	6.36231
16	6.081758	6.18358	51	6.08568	6.35298
17	4.904084	6.10187	52	5.886081	6.3373
18	7.100176	6.16267	53	6.112976	6.3298
19	6.066841	6.15709	54	6.138415	6.32344
20	6.08553	6.15308	55	6.136469	6.31724
21	6.091402	6.14976	56	6.137391	6.3113
22	6.091444	6.14672	57	6.097429	6.30427
23	6.091444	6.14394	58	6.099334	6.29755
24	6.047961	6.13925	59	6.113941	6.29155
25	6.112976	6.138	60	6.100248	6.28532
26	7.102748	6.18262	61	6.143296	6.2807
27	7.137479	6.22571	62	6.121863	6.27556
28	6.160921	6.22285	63	6.089367	6.26954
29	6.160921	6.22018	64	6.089367	6.26373
30	6.104155	6.21528	65	6.111077	6.25881
31	7.114032	6.25256	66	6.111077	6.25407
32	7.114032	6.28767	67	6.111077	6.24949
33	7.088391	6.31976	68	6.124684	6.24549
34	7.088391	6.35009	69	6.095366	6.2407
35	7.076831	6.37835	70	6.123744	6.23697
			71	6.109177	6.2329
			72	6.109177	6.22896

73	6.109177	6.22516
74	6.109177	6.22148
75	6.109177	6.21792
76	6.109177	6.21448
77	6.109177	6.21115
78	6.109177	6.20793
79	6.109177	6.20482
80	6.109177	6.2018
81	6.109177	6.19888
82	6.135529	6.19689
83	6.111996	6.19422

Fatigue Mood		
Cycles	current	update
1	6.11192	6.05141
2	6.04394	6.04769
3	6.02895	6.04145
4	6.95656	6.27046
5	6.95656	6.40823
6	6.0263	6.3441
7	6.95467	6.43233
8	6.95467	6.49868
9	6.99407	6.5549
10	6.99407	6.60002
11	6.93288	6.6313
12	6.93288	6.65746
13	7.00801	6.68574
14	4.88272	6.54961
15	4.88272	6.43115
16	6.07674	6.40733
17	6.07674	6.38622
18	5.83826	6.35284
19	5.83826	6.32284
20	6.07436	6.30893
21	6.08171	6.29668
22	5.83826	6.27282
23	6.06378	6.26229
24	6.06378	6.25259
25	4.98664	6.19245

DECLARATION

This paper has been neither published nor submitted for publication, in whole or in part, either in a serial, professional journal or as a part in a book which is formally published and made available to the public.

The Total quality management implementation through human resource practices in online banking sector beneath Indian changing environment: The Technological concerns

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Abstract— It is a verified indisputable fact that unit of time practices create any organization to boost to the expectations from all services. The banking industry isn't associate degree exception. Within the method the assorted areas connected to the Human Resource Development are given. With due to the service sector Banking could be a predominant and its contribution is critical for the economic development of the country. As a part of study a number of the choose business banks and Grameen Vikas Banks are coated. The terribly nature of the analysis for the study is descriptive and quantitative aspects are given where accessible and required. Beneath the dynamic environment the most recent call of demonetization and its impact on banking services and conjointly on customers given. For this purpose the discussions command with the social control employees of assorted choose banks and therefore the opinions of the various customers are analyzed and given. The shoppers cluster is largely unorganized and its reactions and responses are terribly vital for the progress of the banking establishments and at identical time the effective communication among the stake holders is equally important for the graceful implementation of policies on current challenging scenario. The current study aims to contribute during this direction to improving the performance of current structure of Indian Banking Sector. The study focus on Total Quality improvement of running services.

Keywords- *assorted; Demontization, Dynamic enviourmrnt, Grameen Vikash Bank, HR development; TQM*

I. INTRODUCTION

The digital banking service sector is largely growing and spreading totally different areas occupying a crucial position and contributory considerably for the event of Indian economy. The distinctiveness with this sector is its intangible merchandise within the sort of services. Due to the method of delivering the services human resources play an on the spot role in providing varied services to satisfy the vary of consumers. The specialty of this explicit sector is development and distributions are done at an equivalent time in each thing. The groups of people are concerned in providing the merchandise and receiving the merchandise. It's not therefore

tangible merchandise. With the direct interaction of groups of people quantity of a large amount such a lot of psychological aspects and physiological aspects amount to a good extent that decides the standard of service merchandise. Within the quick ever-changing atmosphere a number of the services are being offered by the robots too however this section is confined to extremely technical areas that to in few countries. However these robots don't replace the human resources no means. Within the total service sector the banking division is therefore important within the sense that everyone is well connected and that they decide the destiny of the state. Within the method of economic development on current challenging environment Banks play a crucial role in implementing the government policy and conjointly acting as a defender of belongings.

The quality of banking services depends on the policies and practices of that establishment in Human Resource Development wing. The fabric they deal is incredibly precious and further care is to be taken in providing the services. however the recent developments like demonetization have affected the banking practices with tremendous quantity of pressure. A trial is being created through this paper to probe in to the 60 minutes practices within the lightweight of technological developments and conjointly the impact of demonetization on banking services within the last 18 months. For this purpose each primary and secondary sources of information are used.

The primary information within the style of opinion survey conducted among bank officers set notably in West UP. The secondary information sources embody banking journals and reports. The analysis methodology dominates with descriptive analysis and quantitative information is additionally enclosed wherever ever potential and accessible. The primary a part of this paper covers the hour practices in banking sector with the support of adjusting technology. The second half covers the recent developments that affected the banking practices due demonetization. So that it's temporary part the import is to gift the banking services underneath the money crunch, software

implementation, online services, core banking services, work pressure and high volume of business transactions.

At present, The competition is extremely high within the banking sector. Each single establishment has got to face this case and emerge as victorious, however it's not as straightforward united may imagine. However this might be potential, if workers want to figure along and so transformation is created potential. Fast-paced and sophisticated world of latest techniques & skills had forced banks to think about it and to regulate themselves to the ever-changing banking atmosphere. There's associate pressing have to be compelled to advance competencies i.e. skill, information, Technology, internet and approach among the bank workers to form them healthier and acceptable to the ever-changing circumstances. And this can be potential as long as economical and effective Human Resource Practices square measure followed which might maximize the worth and minimize value among the organization. However there's no single apply to that all organizations ought to aim, however to some extent, every firm should have a characteristic Human Resource Management System that represents core competencies needed for the survival and sustenance of that specific organization. Best for one firm might not be best for different. The most effective technique applied last month might not be best for these days. Then once during this challenging competitive world, management of human resources had been a matter of crucial issue for fulfillment within the industry. Higher management of human resource had been a lot of in earnest felt as a significant, in recent decade as before. Thus, with a read of the certainty of Human Resources within the banking sector, the aim of this study was to look at 60 minutes Practices followed by public sector banks.

II. THE BACKGROUND

The core banking activities and electronic banking square measure exigent extremely experienced hands within the banking establishments. If we tend to observe the tutorial qualifications of the banking personnel, even with higher instruction individuals were appointed within the initial amount of firm of banks and within the latter amount graduates and post graduates got the positions within the banks. If you see this position candidates with high mathematical and laptop skills are becoming recruited. once liberalization and competitive atmosphere, this banking practices in Asian country square measure additional mature in terms of provide and Technical Environment. However still the agricultural Asian country remains a challenge for the personal sector and foreign banks. In terms of quality of assets and capital adequacy, Indian banks square measure thought-about to own clean, sturdy and clear balance sheets relative to alternative banks in comparable economies within the globe. The Federal Reserve Bank of Asian country is Associate in Nursing autonomous body represents government policy. Within the recent past the planet economy has long-faced the recession. Most of the well-established banks within the world were gone in to adopting the advanced mechanism. However the banks in Asian country have very little impact because the practices square measure elegant with inherent safeguards for the loan sanction and additionally for recovery. The Indian industry is

stronger on very important banking parameters than alternative BRIC nations; this can be discovered during a survey applied by Federation of Indian Chambers of Commerce and business. The Indian restrictive system is far higher than that of China, Brazil and also the uk (UK). The chance management systems square measure additional advanced than China, Brazil and Russia and credit quality higher than China, Brazil, Russia, GB and also the America. Moreover, Indian banking technology systems are superior as compared to Brazil and Russia. However, public, personal and foreign banks square measure subjected to issue in hiring extremely qualified candidates attributable to their demand for top earnings and with high attrition rates. The personal Banks square measure targeting the senior and well veteran personnel within the public sector banks to require them in to their fold by giving engaging salaries. The golden hand shake theme publically sector banks and alternative VRS schemes have created an enormous vacuum within the body personnel significantly within the space of client relations. The employees coaching that may be a continuous method and coaching centers need to plan the terribly method of coaching with new pedagogy and innovative ways. The feedback should create the coaching programs simpler and also the edges ought to percolate to the end-users viz. the interior and external customers.

III. THE HUMAN RESOURCE DEVELOPMENT IN INDIAN BANKING SECTOR

Liberalization has brought changes within the economy, also as within the banking sector. things has additionally thrown challenges for banks normally, and public sector banks specifically. The conditions demand Human Resource Management (HRM), is most significant part within the business method evolution and post-liberalization, has given it a distinguished and strategic place. The unit of time practices in banks in post easement amount square measure modified each technically and physically putting the banks to contend with the world players. The \$64000 challenge for Indian banks is a way to rework into world companies while not losing the normal values and culture that they need imbibed among the employees. The mega banking idea has are available to active thought by the central government additionally go into identical direction. As most a part of the activities in banks is repetitive and routine in nature, the HRD Department needs to struggle to form them a lot of innovative and artistic. The emergence of a core and peripheral force in several organizations has given new challenges for unit of time department of public sector establishments. The banks square measure using folks on contact basis and additionally on commission basis within the kind of casual and part-time staff, consultants, facilitators & business partners resulted in no job security and also the absence of belongingness.

The core operate of HRD within the banking system is to facilitate performance improvement, measured not solely in terms of economic indicators of operational potency however additionally in terms of the standard of economic services provided. Factors like skills, attitudes and information of the human capital play a crucial role in crucial the fight of the money sector. the standard of human resources indicates the flexibility of banks to deliver worth to customers. Capital and

technology square measure replicable however not the human capital that has to be valued as a extremely valuable resource for achieving the competitive edge. The primary stress must air group action human resource management methods with the business strategy. HRM methods embrace managing amendment, making commitment, achieving flexibility and rising cooperation.

IV. ADVANCEMENT IN INDIAN BANKING SECTOR

The Prime Minister of India had proclaimed the demonetization of 500 and 1000-rupee notes regarding 16 months back. Currently it's history. However throughout the months of Nov-Dec 2016 the banks were virtually mobbed by the shoppers attributable to the choice. This is a part of the paper covers the human resources aspects throughout the declared amount. The shoppers got specific amount to deposit the previous currency in bank accounts or exchange them for brand spanking new notes at banks and post offices. In our economy regarding seventy to eighty per cent transactions are money based mostly and at identical time within the total currency these two extremely denominated notes occupy eighty six per cent of current currency. This call moved the shoppers to approach banks. There are clear instances wherever the shoppers stood in long queues for hours along at ATM centers and conjointly at the banks.

The objective of the govt. is also to eradicate black cash, and to bring new energies to economy. However the Central Government has not done correct exercise and it absolutely was below ton of pressure attributable to the criticism by the opposition parties. Usually in giant economies, money element is also at around 5 % of value however in our country it's between twelve to 14 %. Majority of Indian population has no access to money establishments. The most reason for this case is, majority banks are focused in urban and semi-urban areas however most Indians sleep in rural areas. However there are rural banks making an attempt to hide this gap. However these banks need to equip and go a protracted thanks to cowl the overall rural population. Jana Dhana Yojana may be a theme introduced by the Central Government in 2014. On the day itself, 1.5 large integer (15 million) bank accounts were opened below this theme. By fifteen July 2015, 16.92 large integer accounts were opened, with around twenty,288.37 large integer were deposited below the theme that conjointly has associate possibility for gap new bank accounts with zero balance. This agitated job was with success completed by the bank employees. The unpleasant development is these accounts were conjointly wont to convert the black cash in to white. However the tax authorities and vigilance departments are operating with CC Cameras to spot the culprits and conjointly to visualize the black cash. During this method the human resources involvement is well appreciated by the central Government as well as the Prime Minister. At identical time there are few lapses on the bank employees. It conjointly came in to note that few bank officers and extremely few key officers in tally have conjointly concerned within the corrupt practices and are planning to be admonished by the department as per the Act.

The recent central budget has given the due importance for digital banking, on-line banking. The reduction of duties on POS (Point Of Sale) or Scrapping machines more strengthen this concept. Forcing businesses to use the banks and digital payments can facilitate to bring them within the tax internet. However the purpose is behind of these technical developments human resource support is extremely very important.

It is discovered that solely 5 % of Indian staff pay tax, simply 15 % of the economy is within the tax internet and India's tax to value quantitative relation at 17 % is five points below comparable countries. However the money Minister recently mentioned within the house of Parliament on the day of Budget, that the govt. employees' tax internet occupies cheap place and more he reiterated the workers category is honest in payment of taxes compared thereupon of different heads in Direct Taxes. A lot of of India's cash-based client transactions have ground to a halt. Attributable to these developments technology ought to head to support digital banking transactions more.

A. *Advancement on technology based*

The Self-Healing Branch is an automatic service that keeps branch technology up and running by display, application and network performance in real time. built to drive continuity, the Self-Healing Branch lets banks specialize in the client, not on technology challenges.

Leveraging CompuCom's ASCEND™ Digital Platform, the Self-Healing Branch mechanically detects and resolves problems, outages and failures before they impact staff or disrupt business, decreasing issue resolution from hours – or maybe days – right down to minutes, saving vital time and cash.

B. *Development on upgrading Technology*

The Asian country banking sector has been evolving since the year 1770 once the Bank of geographical area was established in Kolkata and later in its numerous avatars-when the overall Bank of India, that came into existence in 1886 once more in Kolkata; so Bank of Calcutta (later Bank of geographic area - 1806), Bank of Mumbai and Bank of Madras merging in 1921 to become the Imperial Bank of India that became the depository financial institution of India (SBI) in 1955.

The Indian banking industry saw another section of metamorphosis in 1969 once all the leading industrial banks were nationalized by the then prime minister and minister, solon. The third section that really started ever-changing the face of the Indian banking was the post-1991 economic relaxation that spread out the banking sector to increased competition and transformation providing higher fare to customers.

C. *Technology to the fore*

Banks have modified in their operations and affected towards universal banking in conjunction with the increased usage of technology and technology-based services providing alternate channels like sensible cards, ATMs, usage of the net, mobile and social banking. Banks have started deploying core

banking, human resource management (HRM) and enterprise risk (ERP) management and method re-engineering etc to boost on their performance and productivity. Majority of banks area unit demand on cashless and paperless payment modes.

According to a KPMG study, a pursuit analyst says, as of FY2012, non-cash payments set up ninety one per cent in worth terms as compared to eighty eight per cent in FY in 2010 and forty eight per cent in terms useful from thirty five per cent in FY 2010. A bank analyst says the payments created through cheques in total non-cash dealing too has return all the way down to fifty two per cent from eighty three per cent in volume terms, and to 9 per cent from eighty five per cent in worth terms throughout between FY 2006 and FY 2012.

D. Indian banks get advertisement globally

This has resulted in swing twenty Indian banks in their standing globally. In 2010, the UK-based complete Finance's annual ranking place these banks within the prime five hundred banks by their complete worth. In 2007, solely six Indian banks had the highest standing globally.

To see any growth within the banking sector regulators and policy manufacturers are emphasizing on monetary inclusion to hide all sections of the society. Half India's population doesn't bank. The regulators and policy manufacturers have started taking a significant read of this. As a result, the highest regulator the bank of Asian country (RBI) is currently encouraging numerous entities as well as non-banking finance corporations (NBFCs), co-operative banks, regional rural banks (RRBs), assist entities, business correspondents in rural areas and microfinance corporations that have currently given exposure to non-banked rural areas. This shows that at some purpose of your time banking services would reach rural areas the maximum amount as they are doing in urban and semi-urban areas.

The government and therefore the regulator have taken many measures together with necessary gap of a minimum of twenty five per cent of recent bank branches in unbanked rural areas, giving impetus to gap of recent branches in tier III-VI cities. The necessary and simplified apprehend Your client (KYC) particularization for gap little accounts have created things easier for banks to increase their reach.

Banks have conjointly become finance suppliers for community services development. Post-liberalization India has conjointly been attracting banks from varied foreign lands. These currently range forty - from twenty eight in FY in 2008 and have a seven per cent share of the full assets management. Over twenty Indian banks have currently opened over 240 offices overseas.

E. Future outlook

The industry should implement Basle III pointers as per the directive of the run to create it a stronger sector. A number of the key measures of this embody making firm measures to create it foolproof of general risks, tight timelines, current improvement of quality and amount of capital, liquidity risk management, value-based practices, solid mechanism,

disclosures for total transparency and reduction of general risk in spinoff and alternative money-related markets.

The run has stipulated a time-frame of 5 years to implement Basle III norms. however there square measure economy connected hurdles because the government that holds majority stake within the public sector banks (PSBs) copes with the high business enterprise deficit. Once the govt. decides to dilute its shares within the PSBs and brings it all the way down to around fifty one per cent, the Indian banking sector would see a shift. Also, an outsized range of foreign players and large Indian corporates square measure awaiting government clearances for putting in place new generation banks. Once there's clarity on this issue things would modification drastically.

F. EXPANSION OF BANKING INFRASTRUCTURE

The ICT revolution has had an excellent impact on the Indian industry. The utilization of computers has junction rectifier to the introduction of on-line banking in India. the utilization of computers within the banking sector in India has accrued by several folds when the economic relaxation in 1991, because the country's banking sector has been exposed to the world's market. Indian banks were finding it tough to vie with the international banks in terms of client service, and there's a desire to use the most recent technology.

V. THE RESERVE BANK OF INDIA INITIATIVES

The computerization began from 1993 with the settlement between IBA and bank employees' associations. In 1994, the Committee was fashioned on Technology problems regarding payment system cheques within the banking system. It emphasized Electronic Funds Transfer (EFT) system, with the BANKNET communications network as its carrier. It conjointly same that MICR clearing ought to be originated all told branches of all those banks with over one hundred branches. For this purpose special coaching sessions were conducted to counterpoint the human resources. In 1995, the Committee was liable for proposing Legislation on Electronic Funds Transfer and alternative Electronic Payments emphasized below new system. In 2008 the bank of Republic of India introduced a system to permit Cheque Truncation—the conversion of checks from physical type to electronic type once causing to the paying bank—in India, the cheque truncation system because it was identified was initial enforced in city Region and so unfold throughout the country. In Gregorian calendar month 2016, Deputy Governor of the tally urged the banks to develop applications for Digital Currencies.

A. Automated Teller Machine (ATM)

The total variety of cash dispenser Machines (ATMs) was put in in Asian country by varied banks. The new non-public sector banks in Asian country have the foremost ATMs, followed by off-site ATMs happiness to SBI and its subsidiaries then by nationalized banks and foreign banks, whereas on-the-scene is highest for the nationalized banks of Asian country. The small print area unit conferred below within the kind of a table.

Branches and ATMs of Scheduled Commercial Banks at the end of December 2017

S. No	Bank Name	Branch	ATM
1	Public Sector Banks	91,445	148,555
2	Nationalized Banks	67,434	89,292
3	Private Sector Banks	24,661	58,833
4	Foreign Banks	288	966
Total		183,828	297,646

Source: RBI Reports

The ATM networks are hit by total chaos, whereas run struggled to print replacement currency. nearly fifty deaths are reportable among the purchasers forming long queues at banks. however at a similar time bank staff have performed their duties day and night worked exhausting to satisfy the overall public with money crunch. There aren't any reports within the media on the health condition and welfare of the bank employees throughout that turbulent amount created by the govt.

VI. GRAMIN VIKAS BANK

The Grameena Vikasa Banks (GVB), earlier termed as regional rural banks are conducive for the Indian economy since its origination means back in 1975. The sponsoring banks or the parent banks and NABARD are funding these banks as per the guide lines of tally. However when easing these banks are the worst sufferer because of profit creating has become the key criterion for its existence. The terribly idea of rural development had taken the second position. It's determined that a number of the GVBs have shifted their location from the villages to outskirts of cities and semi-urban areas to extend their volume of business. The business practices in GVB still stay superannuated and HRD practices are of poor standards. Once the essential problems mentioned with employees operating in GVBs, they unconcealed their discontentment with the service matters and pay parities and conjointly discrimination within the allowances compared with the employees operating in regular industrial banks. there's no correct co-ordination among the industrial banks and GVBs in sharing the infrastructure and conjointly HRD coaching programs. The employees within the industrial banks appearance down at the employees operating in GVBs.

The decision of ending had a sway on villages too. Few villages have ATMs and therefore the rural customers are forced to maneuver into cities and wait in line for hours along to urge significantly within the month of Nov 2016 and resulted within the loss of daily wages, same is that the case with jinrikisha drivers, street vendors, domestic employees and daily laborers within the cities too. the development trade was badly hit with important wage implications for its casual work force. The co-operative banks within the villages weren't given correct place throughout the initial amount of ending. Even whereas supply the new currency and little denomination notes

these banks are given subsequent preference. because of this the employees was subject to heap of pressure from the agricultural customers.

Physical similarly as virtual growth of banking through mobile banking, net banking, tele banking, bio-metric and mobile ATMs is going down since last decade and has gained momentum in previous few years. By 2010 itself, banking in Bharat was usually fairly mature in terms of offer, product vary and reach-even although reach in rural Bharat still remains a challenge for the non-public sector and foreign banks. Usually the sensation is banking concern of Bharat is Associate in Nursing autonomous body and freelance in nature however within the recent times comments are gone along skilled teams on the pressure from the govt. With the expansion within the Indian economy expected to be robust for quite some time-especially in its services sector-the demand for banking services, particularly retail banking, mortgages and investment services area unit expected to be robust. One may expect M&As, takeovers, and plus sales.

VII. DATA SECURITY MANAGEMENT

The Banking Codes associated standards Board of India is an freelance and autonomous body that monitors banks in India. This body aims to enhance the standard of banking services within the country. A large breach of information and issue of debit cards by varied Indian banks was reported in October 2016. it absolutely was calculable 3.2 million debit cards were hacked. Major Indian banks-SBI, HDFC, ICICI, affirmative Bank and Axis Bank were among the worst hit. Several users reported unauthorized use of their cards in locations in China. This resulted in one in all the India's biggest card replacement drive in Indian banking history. The most important bank in Republic of India, depository financial institution of Republic of India had declared the interference and replacement of just about 600,000 debit cards. These developments injury the great can of the banks and therefore the human resources within the bank are not any means accountable.

VIII. DATA SECURITY MANAGEMENT

It is well established proven fact that the human resources are terribly very important for the success of any organizations and banks aren't an exception. Within the fashionable industry the technology is taking part in a predominant role and once the human resources are totally trained within the technical areas then their contribution is going to be a lot of in providing the standard services and additionally to take care of healthy client relations. The multi-skilled forces with updated coaching from time and with potted ever-changing policies are going to be a lot of appropriate to hold on banking operations. The direct interaction with customers is most superannuated notably in urban areas. At present, it's solely through a technical device the transactions do happen. During this method client Relationship Management is more difficult. The info security measures are a lot of necessary and cyber-crimes are increasing and customary customers are the worst sufferers. A little question that the government naturally can come back to rescue of shoppers, however that's not the answer for the matter. A fool proof mechanism is that the want of the hour to confirm customers on the technology advancement. Even the well-

educated customers aren't happy with e-pass books and that they are happy only if their pass books are updated within the sort of textual matter.

CONCLUSION

The industry is undergoing a competitive atmosphere within which the human resource management takes outstanding place in transferral a position to the business. The hour coaching institutions should rise to the occasion with updated versions each in contents and presentation strategies. The banking division in Republic of India is extremely complicated with Brobdingnagian volume of business. it's complicated because it includes Public sector banks, Industrial development banks, GVBs, co-operative banks, personal banks, foreign banks and alternative money companies. The client phase varies in line with the sort of bank. The organizations got to train the human resources as per their necessities. the govt should give infrastructure facilities to implement the digital banking. The coaching centers should focus a lot of on sensible technical aspects than the abstract base. there's a desire of association among the banks to share the developments, talent set and infrastructure.

The rural market continues to be unknown in our country and awareness among the agricultural community on the banking services still has to be highlighted. the information security measures square measure very important on digital banking and more analysis on electronic banking protects the interests of shoppers from hacking and falsity. The day isn't far away wherever banks in India could challenge the foreign banks not solely in India and additionally at international level. the purpose is to trot out international customers the human resources should be trained effectively to face the challenge.

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DS-NIZKP: A ZKP-based Strong Authentication using Digital Signature for Distributed Systems

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Abstract— In most networks and distributed systems, security has always been of a major concern and authentication is the core issue as it provides protection from unauthorized use and ensures proper functioning of the system. This paper investigates and proposes DS-NIZKP, an approach for authenticating users by three factors, (namely password, smart-card and biometrics) based on the concept of Zero Knowledge Proof (ZKP), so that no sensitive information can be revealed during a communication. The proposal employs the concept of digital signature (DS) to authenticate the identity of the sender or the signer within a single communication. Given that DS employs asymmetric encryption, a one-way hash of the user's identity is created then signed using the private key. Hashing prevents from revealing information about the user while signing provides authentication, non-repudiation and integrity. This approach not only saves time since just a single message between the prover and the verifier is necessary but also defends privacy of the user in distributed systems.

Keywords- Authentication; Digital Signature; Distributed System; Security; Three-factor authentication; Zero Knowledge Proof (ZKP)

I. INTRODUCTION

A distributed system is a collection of autonomous computational entities interconnected by a communication network. Each entity (also called node) in a distributed system has its own computing resources and is able to communicate with others in the system. A fundamental concern in building a secure distributed system is authentication of local and remote entities in the system [1]. Basically, authentication refers to a process in which a node (or user) provides some form of proof on his identity in order to access the system, under which he had previously registered for an account. This consists in proving that he is the same user who registered the account. In simple terms, authentication is identification plus verification [1]. A proof of identity can be any piece of information that an authentication server accepts: something users have in their possession, something they know or something they are [2]. The security of local or remote authentication mechanisms mostly relies on one of or the combination of three previous

factors: something users know (like password), something users have (like smart card), and something users are (biometric characteristics like fingerprint). Also it is important that no authentication information leaks while authenticating a user in order to avoid a third party to impersonate a legitimate user. Zero knowledge protocols can be used to improve on this. In ZKP, a prover will try to demonstrate knowledge of a certain secret to a verifier without revealing any information whatsoever about the proof itself, except of course for the fact that it is indeed a valid one [3]. This paper focuses on the authentication issue and proposes a ZKP based authentication mechanism in a distributed system environment.

The rest of this paper is organized as follows: section 2 reviews related works on various authentication aspects in distributed systems. Section 3 presents a brief review of the cryptographic concepts that are relevant to the construction of our authentication scheme. In Section 4, we propose an authentication framework for distributed systems (the DS-NIZKP-based authentication). We first discuss the system setup and give an overview of the protocol before elaborating the details in each phase of the authentication. Section 5 assesses and provides some security proofs in relation with the proposal. Finally, conclusion remarks and perspectives are given in section 6.

II. RELATED SURVEY

Several works have addressed the issue of user authentication in distributed environments since it is an essential factor to the security of data and communications among users. As a matter of fact, due to a wide spread use of mobile devices, a user can access various location based services or communicate with peer users almost everywhere he or she goes, through dynamically and temporarily formed networks [4]. Typically, user authentication is based on one or more of something users know, something users have and something they "are" [2] [5] [6]. Something user knows refers to password or PIN, social security number, mother's maiden name, pet's name, a picture, etc. Something users have include physical key, proximity card, RSA SecureID token, smart card

or credit card, SecureNet token, Cell phone, etc. Finally something they are typically refers to biometrics (face, fingerprint, voiceprint, iris, etc).

The most early authentication mechanisms (also known as password-based authentication) were solely based on password [5] [6]. Even though passwords are still efficient and relatively easy to implement and manage, they have shown limits in some cases (guess of passwords in relatively short time by simple dictionary attack when simple human generated passwords are used). Due to these concerns, hardware authentication tokens (such as smart-card-based password authentication) were introduced in order to strengthen the security in user authentication [5]. Another authentication mechanism is biometric authentication [2] [6] [7], which mainly employs measurable human characteristics such as fingerprint, voiceprint and iris scan to identify users. Thus multiple-factor authentication has become one of the most common authentication mechanisms given that it combines two or more factors in the authentication process to enrich the existing system and yield strong authentication.

A. Two-factor based authentication

Two-factor authentication (2FA) typically refers to using two means of identification to authenticate users. These could be a password together with a hardware token such as smart card, personal mobile device, or a hand-held token [9]. A common example of two factor authentication is when you use your ATM card to withdraw money from your bank account. Several two-factor authentication schemes have been proposed in the literature [8] [10] [11]. They were introduced to improve the shortcomings of password-based authentication and have enhanced security in authentication systems by providing an additional security layer (the token used). Indeed, smart cards have embedded electronic certificates that are used to identify the holder [9]. A comparative usability study of two-factor authentication was conducted in [12] and it was found that they are overall perceived as usable, regardless of motivation and/or context of use. Likewise several commercial two factor authentication systems exist today such as BestBuy's BesToken, RSA's SecurID, and Secure Computing's Safeword [14].

However, all 2FA schemes present drawbacks. Just as indicated in [8], research carried out in [13] on some two-factor authentication schemes pointed out they were vulnerable to impersonation attacks. This is due to the fact that users' credentials may be compromised and possibly abused if they lose their tokens. Also it is difficult to ensure that the person using the token and password to access the system is actually the owner who should be the legitimate person. A further drawback is the potential for the system to be unavailable to a valid user in situations where the token is lost or malfunctions [9]. Therefore, for a system whose users need high security requirements, two factor authentication schemes may be not secure enough [7] [8]. To solve this problem, three factor authentication schemes have been introduced.

B. Three factor based authentication

This refers to using three means of identification to authenticate users such as a password together with a hardware token and the user's unique physical or behavioral characteristics (referred to as biometrics). The latter can include fingerprints, voiceprints, hand geometry, retinal or iris scans, handwriting, or keystroke analysis [2] [6] [9].

C. Biometric authentication

Biometric characteristics are believed to be a reliable authentication factor since they provide a potential source of high-entropy information and cannot be easily lost or forgotten. Despite these merits, biometric authentication has some imperfect features. Unlike password, biometric characteristics cannot be easily changed or revoked. Some biometric characteristics (e.g., finger-print) can be easily obtained without the awareness of the owner. This motivates the three-factor authentication, which incorporates the advantages of the authentication based on password, smart-card and biometrics [5].

D. Zero Knowledge Proof authentications

Zero Knowledge Proof (ZKP) is an interactive protocol which enables one party (the prover) to demonstrate knowledge of a certain secret to another party (the verifier) without revealing any information about the secret itself. This protocol can be solved by using mathematical problems like random numbers, discrete logarithms and integer factorization [3] [15] etc., to improve security. Typical ZKPs are based on several challenges and responses, involving a successive exchange of messages, which implies a very high communication cost. An extra consequence is the need to have a stable and continuous connection between nodes [16]. A ZKP must fulfill three main properties: completeness, soundness and zero-knowledge [3] [8] [17]. *Completeness* means that for any valid input, a prover P can always complete the proof successfully (i.e. the verifier accepts the prover's claim). *Soundness* ensures that no malicious prover P can construct a valid proof system (i.e. the verifier can never be convinced by any prover if its claim is false). *Zero-knowledge* guarantees that no malicious verifier V is able to derive extra knowledge from the interaction (i.e. the verifier cannot learn anything except the fact).

The concept of Non-Interactive ZKP (NIZKP) [8] [17] [18] [19] had been introduced to address the issue of successive exchange of messages in user authentication which has a non-negligible impact on the lifetime of the system in terms of resources usage. In an NIZKP, all of the challenges of a typical ZKP are condensed into a single package and sent in a single message [17]. This results in considerably reducing the time necessary to exchange messages, given that only a single message is sufficient to verify user's identity. In this research, node authentication is performed via a NIZKP-based approach using digital signature called DS-NIZKP. This approach employs digital signature with hash function to provide zero-knowledge and authentication of both the sender and message.

E. Cryptography and Digital Signature

Cryptography is the science and study of secret writing whereby sensitive information can be stored or transmitted across insecure networks (like the Internet) so that it cannot be read by anyone except the intended recipient. The foundations of cryptography are the paradigms, approaches, and techniques used to conceptualize, define, and provide solutions to natural security concerns (such as confidentiality, data integrity, access control, and authentication) [21]. Figure 1 shows how cryptography works. A cryptographic algorithm works in combination with a key (a word, number, or phrase) to encrypt the plaintext.

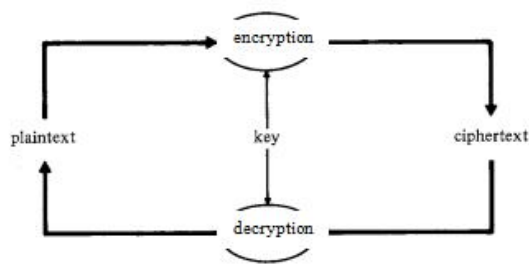


Figure 1: How cryptography works

The methods of cryptography render a message unintelligible to outsiders by various transformations of the text [20]. Plaintext is data that can be read and understood without any special measures. The method of disguising plaintext in such a way as to hide its substance is called encryption. Encrypting plaintext results in unreadable text called ciphertext. Encryption to ensure that information is hidden from anyone for whom it is not intended, even those who can see the encrypted data. The process of reverting ciphertext to its original plaintext is known as decryption.

There are two kinds of cryptography: conventional and modern cryptography. In conventional cryptography (also called secret-key or symmetric-key encryption), one key is used both for encryption and decryption whereas in modern cryptography (also called public-key or asymmetric-key encryption) two different keys are used. For better understanding, we present a brief review of the cryptographic concepts that are relevant to the construction of our authentication scheme.

Digital signature is one of the first tasks that joined encryption to form modern cryptography. A digital signature is an authentication mechanism that enables the creator of a message to attach a code that acts as a signature. Typically the signature is formed by taking the hash of the message and encrypting the message with the creator's private key [20]. DS ensures the source, integrity and non-repudiation of the message. Digital signatures employ asymmetric encryption and typically consist of three algorithms:

- A *key generation* algorithm: generates *private key* and *public key* for a signer
- A *signing* algorithm: produces a signature from a given a message and a private key

- A *signature verifying* algorithm: given the message, public key and signature, either accepts or rejects the message's claim to authenticity.

Since the advent of the digital signature concept, many signature schemes have been proposed [8] [20]: RSA, ElGamal, Shnorr, DSS. All these DS schemes have the following requirements [20]:

- A signature must be a bit pattern that depends on the message being signed,
- A signature must use some information unique to the sender to prevent both forgery and denial,
- It must be relatively easy to produce the digital signature,
- It must be relatively easy to recognize and verify the digital signature,
- It must be computationally infeasible to forge a digital signature, either by constructing a new message for an existing digital signature or by constructing a fraudulent digital signature for a given message,
- It must be practical to retain a copy of the digital signature in storage.

A secure hash function, embedded in a scheme, provides a basis for satisfying these requirements. However, care must be taken in the design of the details of the scheme.

A **hash function** is a one that takes a variable-length message as input and transforms it into a fixed-length output called hash value or message digest. The main goal of a hash function is data integrity. Indeed, a change to any bit in the message, results with high probability, in a change in the hash value. Hash functions are employed for a wide range of applications such as Message Authentication and Digital signatures. The general operation of a cryptographic hash function is illustrated on Figure 2.

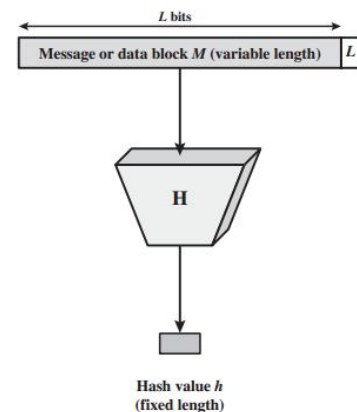


Figure 2: Block diagram of a hash function, source [20]

Here we consider cryptographic hash function which meets three main properties [8] namely:

- The hash value is easy to compute for any given input message

- It is unfeasible to find two distinct messages with the same hash value
- It is unfeasible to recover a message from its hash value

A good hash function has the property that the results of applying the function to a large set of inputs will produce outputs that are evenly distributed and apparently random [20]. The Secure Hash Algorithms (SHA) are a family of cryptographic hash functions which are commonly used. SHA-3 is the latest of this family and is based on an algorithm called Keccak. Keccak is a permutation based algorithm that NIST selected as the winner of the SHA-3 Cryptographic Hash Algorithm Competition [23]. Even though it supports the same hash lengths as SHA-2, SHA-3 has the ability to run on many types of devices, as well as its facility in performing better than the others. With Keccak, it is possible to target a given security strength level by choosing the appropriate capacity, i.e., for a given capacity c , Keccak is claimed to resist any attack up to complexity $2^{c/2}$ [17] [23].

In this work, we use a general method for constructing signature out of length-restricted ones. The method consists of hashing a message/document into a short (fixed-length) string (using a SHA-3 algorithm), and applying the RSA signature scheme to the resulting hash-value. With the RSA approach, the message to be signed is input to a hash function that produces a secure hash value of fixed length. This hash value is then encrypted using the sender's private key to form the signature. Both the message and the signature are then transmitted. The recipient takes the message and produces a hash value. The recipient also decrypts the signature using the sender's public key. If the calculated hash code matches the decrypted signature, the signature is accepted as valid. Because only the sender knows the private key, only the sender could have produced a valid signature.

III. PROPOSED APPROACH

In this section, we present the proposed DS-NIZKP-based authentication scheme. We first discuss the system setup and give an overview of the protocol. Then we elaborate on the details in each phase of the authentication.

A. Preliminaries

The main goal of this paper is to propose a strong authentication scheme based on ZKP to avoid disclosure of sensitive information during communication and communication cost is least. Strong authentication involves two or more factors when authenticating users. The proposed scheme uses a three-factor authentication even though it can be adapted to two or more factors. This means it can allow the server to decide the authentication factors in a user's authentication (instead of all three authentication factors). We therefore need a dynamic data structure (such as a linked list) to store users identity information. Since digital signature employs asymmetric cryptography, we assume that an

appropriate key distribution and management system is put in place.

Last, in the proposed scheme clients' authentication information (password, smart card number and biometric information) are kept secret from servers. This means that these information are not stored in clear on the server, rather they are disguised. This not only protects user privacy but also prevents a single-point failure (e.g., a breached server) from undermining the authentication level of other services. Furthermore, the verification of all authentication factors is performed by the server.

We consider authentication to be a function of three (03) parameters: **K**, **P** and **B**, where **K** represents something users know, **P** something users possess and **B** a biometric characteristic of the user. What the user knows yields **id1**; what he has yields **id2** and finally what he is yields **id3**. The identity of the user is then composed of **id1**, **id2** and **id3**, which is stored in the data structure. Each component of this identity is then hashed, using a hash function, to obtain a digest of fixed size. It is worth recalling that hash functions have the following properties:

- One way; which means they cannot be reversed
- The output (digest or hash value) does not reveal information on input
- Collision resistance; which means that it's hard to find collisions (i.e. different messages with same hash)

B. DS-NIZKP-based authentication

The proposed solution consists of 03 stages as described below. A user requesting access to the system needs to go through these various stages during its authentication.

Stage 1: Building user's identity (ID)

We consider authentication to be a function of three (03) parameters: **K**, **P** and **B**

$$\text{Auth} = F(\mathbf{K}, \mathbf{P}, \mathbf{B})$$

with **K** being something users know, **P** something users possess and **B** a biometric information of the user

What the user knows yields **id1**; what he has yields **id2** and finally what he is yields **id3**. The identity of the user is then composed of **id1**, **id2** and **id3** as on shown on Figure 2, which is stored in the data structure (of type linked list).

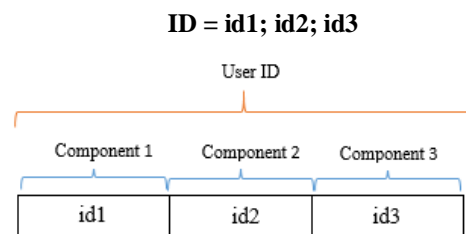


Figure 3 : Components of a user's ID

Each component of this identity is then hashed, using a hash function, to obtain a digest of fixed size. Hashing prevents from revealing personal information of the user, therefore satisfying the zero knowledge property of zero knowledge protocols.

Stage 2: Generating user's signature (Sign)

The user's signature is obtained by encrypting each hashed component of the identity above with the user's private key. This encryption provides confidentiality, non-repudiation and integrity.

$$\begin{aligned}\text{Sign} &= E_{PR}(\text{ID}) \\ &= E_{PR}(\text{id1}) E_{PR}(\text{id2}) E_{PR}(\text{id3})\end{aligned}$$

where E is an encryption function and PR the user's private key

After the signature has been generated, the pair user identity and signature, (ID, sign) is sent to the server for verification.

Stage 3: Verification of user's information

Upon reception of the user's authentication information, the server proceeds to its verification as follows:

- **Verification of user's signature:** the server decrypts Sign using the user's public key and verifies with the received ID information. This is done by comparing each component of the obtained signature, Sign', with those of the ID received.

$$\begin{aligned}\text{Sign}' &= DPU(\text{Sign}) \\ &= DPU(E_{PR}(\text{id1}) E_{PR}(\text{id2}) E_{PR}(\text{id3}))\end{aligned}$$

where D is a decryption function and PU the user's public key

$$\text{Cmp}(\text{Sign}, \text{Sign}') = \text{bool} \quad \text{where Cmp is a comparison function and bool a Boolean value}$$

This assures authentication, non-repudiation and integrity because only the claimed user could have sent such information since he is the only one possessing his private key which was used to encrypt. If all comparisons are successful, then user's signature is valid and its authentication information are reliable. The server can now proceed to the verification of its identity.

- **Verification of user's identity:** the server compares the received information on the user's ID (id1, id2 and id3) with those stored on the server. Again, this is done by comparing each component of the ID with that on the server. If all comparisons are successful, then the user is accepted and access to the system is being granted.

IV. SECURITY ANALYSIS AND PERFORMANCE EVALUATION

This section assesses and provides a formal security analysis of the proposed DS-NIZKP scheme. We start by briefly describing the completeness, soundness and zero-knowledgeness of our approach. Then we analyze and provide some security proofs in relation with the proposal.

Completeness: this property guarantees that both the prover and the verifier will follow the normal protocol. Given that users authentication information are stored on the server, if both parties (in this case the user and the authentication server) follow the protocol properly, the valid identity of a user requesting access to the system can be accepted by the server with probability one.

Soundness: this property ensures that no malicious prover can construct a valid proof. Considering that the authentication server is honest (follows the protocol), then with overwhelming probability, an unauthorized user will not be able to cheat by sending an invalid identity since it is composed of several components and signed using user's private key. An overwhelming probability means the probability is 1 - a negligible probability [22].

As described in section 4, the user generates, hashes and signs its identity to the authentication server. The server checks the validity of the user by checking its signature. For the user to be valid, each component of the obtained signature Sign' should match with those of the one received Sign. Once the user's validity is confirmed, its identity can now be checked. The validity of the user identity ID clearly depends on the validity of its signature Sign and the validity of each of its components id1, id2, and id3. Thus, if the server is honest, it will be able to easily detect the invalid identity (in case there is any invalid ID component by a user). So, there is no way for an unauthorized user to succeed with invalid ID.

Zero-knowledgeness: this property refers that no information whatsoever except the validity of the prover's claim flows to the verifier. On the one hand, users information are not stored in clear on the authentication server. They can be disguised using a hash function such that the server itself cannot learn anything about the user's identity. This also prevents from attacking the server and stealing sensitive information on the users. On the other hand, DS-NIZKP uses a cryptographic hash function to disguise user's personal information before sending to the server. Such functions have the property of making it unfeasible to recover a message from its hash value (one way functions; which means they cannot be reversed). This means, the authentication server receives only the necessary values from the user to individually prove the validity of its identity, but the user does not send any value to the server such that the server individually can reveal the value of an identity. Thus zero-knowledgeness property of the protocol is fulfilled.

From the above discussion we see that, the DS-NIZKP scheme for user authentication presented in this paper satisfies completeness, soundness, and zero-knowledgeness properties of a ZKP. This represents the first security measure for our approach.

The security of the proposed scheme also depends on standards used to implement it: ZKP, digital signature hashing and encryption. The SHA-3 family algorithms which we have chosen are designed to provide special properties, such as resistance to collision, pre-image, and second pre-image attacks [23]. These hash functions are also components for many important information security applications, including the generation and verification of digital signatures [23] which have been used to implement the ZKP. Therefore, the proposal does not suffer from usual attacks based on cryptographic operations (also like identity theft and Man in the Middle attack), because its security is supported by NIZKP based on digital signature, current standard hashing and encryption. It is worth indicating that the type of encryption used here is homomorphic encryption. Homomorphic encryption is a form of encryption that allows computation on ciphertexts, generating an encrypted result which, when decrypted, matches the result of the operations as if they had been performed on the plaintext. The purpose of homomorphic encryption is to allow computation on encrypted data.

V. CONCLUSION AND FUTURE WORKS

In this paper, a flexible and lightweight strong authentication scheme (DS-NIZKP) for distributed systems has been presented. DS-NIZKP uses three factors to authenticate users and a dynamic data structure to store user's identity components, enabling the approach to be used with less or more authentication factors. It is designed based on non-interactive ZKP and homomorphic encryption by allowing each user to self-generate a number of authenticated identities to prove his or her legal status when communicating with peer users, service providers, or other infrastructure. To implement the ZKP concept, digital signatures have been employed for the protection of user privacy. The proposed approach is simpler in that, contrary to typical ZKP systems, there is no interaction between the prover and the verifier: just a single message is necessary.

In the short term, we plan to use and apply the proposed model in other related issues. Also, we expect to propose a distributed approach for the proposed solution, where there will be an agent responsible for authenticating each factor with the server.

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A Review on Privacy and Security Challenges in the Internet of Things (IoT) to protect the Device and Communication Networks

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Abstract— Internet of Things (IoT) plays a vital role in our day to day life and normally used in our houses, in industry, schools and in hospitals which implemented outside to manage and control for taking report the changes in location prevent from dangers and many more favorable things. Moreover all other advantages can approach of big risks of privacy loss and security issues. To protect the IoT devices, so many research works have been measure to find those problems and locate a best way to eradicate those risks or at least to reduce their effect on the security and privacy requirement. Formation the concept of device to device (D2D) communication technology, IoT plays the information transfer from one end to another end as node of interconnection. This paper examines the constraints and security challenges posed by IoT connected devices and the ability to connect, communicate with, and remotely manage an incalculable number of networked, automated devices via the Internet is becoming pervasive.

Keywords— *Internet of Things, D2D, communication Technology, internet, privacy, security, issues, challenges.*

I. INTRODUCTION

Now-a-days the different communication technologies are used to interconnection for the transfer of information, more number of issues in security and privacy sectors. IoT [1] finds its application in the all the fields, since new mode of communication between the different systems and devices. Internet of Things (IoT) also called the internet of everything or industrial network is a wide technology which is been viewed as a global network of machines and devices capable of interacting with each other. The IoT allows things to be controlled remotely across existing network infrastructure, provide opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. If the IOT devices are poorly secured, cyber attackers will use them as gateway to cause harm to other devices in the network. So, here arises the issues in security and privacy and more attention is required in

IoT especially authenticity, confidentiality and integrity cum availability [2] of data and services in IoT.

The main objective of this paper is to highlight security and privacy issues surrounding Internet of Things. In terms of security, IoT is a technology with unlimited challenges because of following reasons:

a) IoT is typically regarded as extension of current internet to several different technologies like Mobile Broadband, Wireless Sensor Network which are open to attack because of various loopholes.

b) In IoT, each and every device is be connected to Internet and Internet is always an unsecured mode which makes all these devices open door for hackers for various breaches and remote code executions

c) If the IoT has a problem, or is exposed to weaknesses, then the enterprises that are connected to it are equally threatened. In fact, while security [27] is undoubtedly one of major issues impacting the development, there are a number of other problems that stem directly from this.

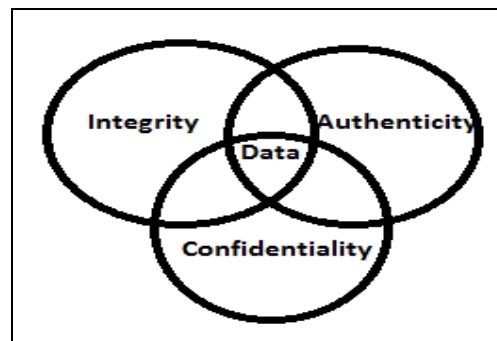


Figure 1 Data Security

Confidentiality makes sure the data at rest or data transferred between end points remains secured through

encryption. Integrity is to make sure the software in the device or any part of the system is protected against unauthorized modification. This can be achieved from different techniques starting from simple hashing to digital signatures using Public key cryptography. Availability is to make sure that the system is available based on the service level expectations. This requires systems to be aware of their weakness and have counter measures built in.

II. KEY ELEMENTS INVOLVED IN IOT

A. Sensing

The first step in IoT workflow is gathering information at a “point of activity.” The information collected may be information collected by the appliance or any devices. The sensing can be biometric, biological, environmental, visual or audible.

B. Communication

IoT devices need a channel for sending collected information at the device level to the Cloud-based service for further processing. This expects either Wi-Fi (wireless LAN based communications) or WAN (wide area network... i.e. cellular) communications. Depending on the need of communication other capabilities may also be required. That may include Bluetooth, ZigBee, Near-field or a range of other short range communication methods. GPS is required for positioning.

C. Cloud Based Capture & Consolidation

Collected data is sent to the cloud based service where the data is combined with other data to produce useful information to the user. Collected information may be forming any sources. Data processing is always required for analyzing.

D. Delivery of Information

Delivery of Information is the last step where the useful information is sent to the user. That may be a consumer, a commercial or an industrial user. The aim is to provide information in a simple and transparent manner. It requires execution of a well thought out, designed and executed user interface that provides an optimized experience across multiple device platforms – tablets, smart phones, desktop – across multiple operating systems – iOS, Android, Windows, etc.

III. PROTOCOLS AND NETWORK TECHNOLOGIES

IoT mainly uses the standard protocols and networking technologies. The most important technologies and protocols of IoT are RFID [9], NFC, low-energy Bluetooth, low-energy wireless, low-energy radio protocols, LTE-A, and Wi-Fi Direct. These technologies hold the explicit networking functionality desirable in an IoT arrangement in dissimilarity to a typical standardized network of general systems.

A. NFC and RFID

RFID (radio-frequency identification) and NFC (near-field communication) offers simple, less energy, and flexible

options for characteristics and contact tokens, connection bootstrapping, and payments. RFID technology utilizes 2-way radio transmitter-receivers [25] to find and trail tags linked with objects. NFC contains communication protocols for electronic devices, generally a mobile device [16].

B. Low-Energy

Bluetooth affords the low-power, long-use require of IoT purpose while uses a normal technology with local support across systems.

C. Low-Energy Wireless

These technologies return the mass power starving attribute of an IoT structure. Even though sensors and additional elements can ability following over extended periods, communication links (i.e., wireless) must remain in listening mode. Low-energy wireless diminish consumption thus extends the existence of the device. The following list shows the protocols involved in internet of things devices and applications.

- Infrastructure (ex: 6LowPAN, IPv4/IPv6, RPL)
- Identification (ex: EPC, uCode, IPv6, URIs)
- Communication / Transport (ex: Wi-fi, Bluetooth, LPWAN)
- Discovery (ex: Physical Web, mDNS, DNS-SD)
- Data Protocols (ex: MQTT, CoAP, AMQP, Web socket, Node)
- Device Management (ex: TR-069, OMA-DM)
- Semantic (ex: JSON-LD, Web Thing Model)
- Multi-layer Frameworks (ex: Alljoyn, IoTivity, Weave, Homekit)

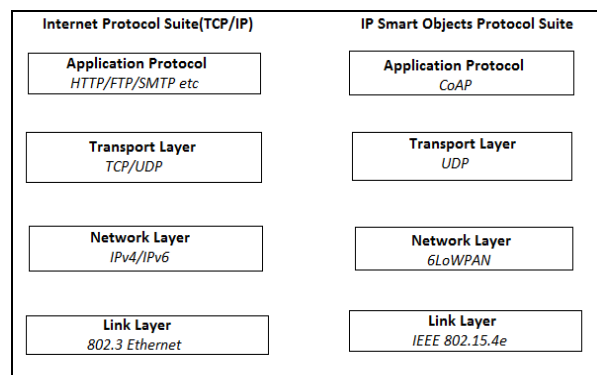


Figure 2 Compare Internet Protocol Suite with IP Smart object protocol suite

D. CoAP

CoAP is designed to enable low-power sensors to use RESTful services while meeting their power constrains. It is

built over UDP, instead of TCP commonly used in HTTP [26] and has a light mechanism to provide reliability. CoAP architecture is divided into two main sub layers: messaging and request/response. The messaging sub layer is responsible for reliability and duplication of messages while the request/response sub layer is responsible for communication.

E. 6LoWPAN

IPv6 over Low power Wireless Personal Area Network (6LoWPAN) is the first and most commonly used standard in this category. It efficiently encapsulates IPv6 long headers in IEEE802.15.4 small packets, which cannot exceed 128 bytes. The specification supports [15] different length addresses, low bandwidth, different topologies including star or mesh, power consumption, low cost, scalable networks, mobility, unreliability and long sleep time.

F. MQTT

It is designed to provide embedded connectivity between applications and middleware's on one side and networks and communications on the other side.

G. Radio Protocols

ZigBee, Z-Wave, and Thread are radio protocols used for establishing low-rate private area networks. These technologies not only use low-power but also offer high throughput. This increases the power of small local device networks without the typical costs.

H. LTE-A

LTE-A, or LTE Advanced, provides an important boost to LTE technology by increasing not only its coverage, but also reducing its latency and raising its throughput. It gives IoT an enormous power by increasing its range, with its most noteworthy applications being vehicle, UAV.

I. Wi-Fi Direct

Wi-Fi Direct removes the need of an access point. It allows P2P (peer-to-peer) connections retaining the speed of Wi-Fi, but with lower latency. Wi-Fi Direct removes an element of a network that often marshes it down and it does not compromise on speed or throughput

IV. BACKGROUND

The most significant features of IoT include artificial intelligence, connectivity, sensors, active engagement, and small device use. An overview of this features are IoT mainly makes virtually anything "smart", meaning it improves every phase of life with the influence of data collection, artificial intelligence algorithms, and networks. New IoT networking mean networks are no longer entirely tied to major service providers. Networks can exist on a much smaller and cheaper scale. IoT creates these small networks between its system devices [10]. IoT loses its merit without sensors. They act as major instruments which transfers IoT from a standard passive network of devices into an active system capable of real-time integration. Most of the interaction with technology is done through passive engagement. IoT paves a new way for active

content, product, or service engagement. Devices have become smaller, cheaper, and more powerful over time. IoT explores purpose-built small devices to deliver its accuracy, scalability, and flexibility [24].

V. ALGORITHM USED IN IOT

Trilateration is the process of shaping absolute or relative locations of points by measurement of distances. Trilateration does have realistic applications in surveying and navigation, including global positioning systems (GPS).

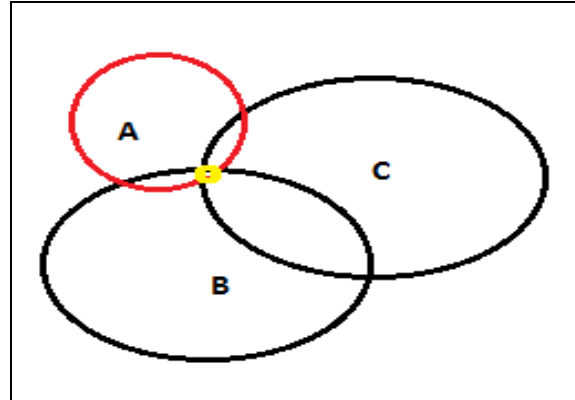


Figure 3 GPS technology determines your location by measuring distances from three satellites, using the mathematical principle of trilateration.

VI. CHALLENGES IN IOT

A. Security Challenges

For many tech firms across the world IoT has become a serious concern in terms of security. The hacking of baby monitors, smart fridges, Barbie dolls, drug infusion pumps, cameras and even assault rifle has caused a nightmare for the future of IoT. So many new nodes being added to networks and the internet will provide malicious actors with innumerable attack [3] vectors and possibilities to carry out their evil deeds, especially since a considerable number of them suffer from security holes. The most important transfer in security will arise from the fact that IoT will become more deep-seated in our lives. Alarms will no longer be narrowed to the protection of sensitive information and assets. Our very lives and health can become the target of IoT hack attacks.

There are many reasons for the state of insecurity in IoT. Some of it has to do with the industry being in its "gold rush" state, where every vendor is hastily seeking to find out the next innovative connected gadget before their competitors do. Under such circumstances, functionality becomes the main focus and security takes a back seat [11, 22]. Scalability issues also one of reason for the creation of unsecure IoT products. The fact is that many security solutions present today have been created with generic computing devices in mind. IoT

devices often lack the computational power, storage capacity and even proper operating system to deploy such solutions.

B. Privacy Challenges

Some of the data collected by IoT are highly sensitive and are protected by legislations such as the Health Insurance Portability and Accountability Act (HIPAA) in the U.S. and are basically different from our browsing and clicking habits. But necessary measures are not taken for storing such kind of data and sharing it with other service providers. Vendors and manufacturers should either discard this data or remove the Personally Identifiable Information (PII) [13] to ensure that consumers aren't damaged in case of data breaches.

Another consideration to be taken is that while data generated about a single appliance may not be sensitive, but when combined with data generated from other devices, it can reveal information such as the life pattern of consumer, which can become very danger if the data fall into the hands of the wrong people. In many cases, criminals don't even need to pry into your encrypted communications in order to obtain the information they want. The IoT creates unique challenges to privacy, many that go beyond the data privacy issues that currently exist. Much of this stems from integrating devices into our environments without us consciously using them.

This is becoming more prevalent in consumer devices, such as tracking devices [14] for phones and cars as well as smart televisions. In terms of the latter, voice recognition or vision features are being integrated that can continuously listen to conversations or watch for activity and selectively transmit that data to a cloud service for processing, which sometimes includes a third party. The collection of this information exposes legal and regulatory challenges facing data protection and privacy law. In addition, many IoT scenarios involve device deployments and data collection activities with multinational or global scope that cross social and cultural boundaries.

Security is an essential pillar of the and most significant challenge for the IoT. Increasing the number of connected devices increases the opportunity to exploit security vulnerabilities [30], as do poorly designed devices, which can expose user data to theft by leaving data streams inadequately protected and in some cases people's health and safety (implanted, Internet-enabled medical devices and hackable cars) can be put at risk. Many IoT deployments will also consist of collections of identical or near identical devices. This homogeneity magnifies the potential impact of any single security vulnerability by the sheer number of devices that all have the same characteristics. Without standards to guide manufacturers, developers sometimes design products that operate in disruptive ways on the Internet without much regard to their impact. If poorly designed and configured, such devices can have negative consequences for the networking resources they connect to and the broader Internet. A lot of this comes down to cost constraints and the need to develop a

product for release quicker than competitors. Add to this the difficulties with managing and configuring larger numbers of IoT devices, the need for thoughtful design and standardization of configuration tools, methods, and interfaces, coupled with the adoption of IPv6, will be essential in the future [6].

Like privacy, there are a wide range of regulatory and legal questions surrounding the IoT, which need thoughtful consideration. Legal issues with IoT devices include cross border data flow [4]; conflict between law enforcement surveillance and civil rights; data retention and destruction policies; and legal liability for unintended uses, security breaches or privacy lapses. Further, technology is advancing much more rapidly than the associated policy and regulatory environments. Regulatory analysis of IoT devices is increasingly being viewed from a general, technology-neutral perspective legal lens, which seeks to prevent unfair or deceptive practices against consumers [29].

C. Technological challenges

Progressing from the Internet of computers to the remote and somewhat unclear goal of an Internet of Things is something that must therefore be done one step at a time. In addition to the expectation that the technology must be available at low cost if a large number of objects are actually to be equipped, we are also faced with many other challenges, such as:

a) Scalability: An Internet of Things has a larger scope than the usual Internet of computers. But then things work together mainly within a local environment. Basic functionality such as communication and service discovery therefore need to function equally efficiently in both small scale and large-scale environments [5, 31].

b) Interoperability: Since the world of physical things is extremely diverse, in an Internet of Things each type of smart object will have different information, processing and communication capabilities. Different smart objects would also be subjected to very different conditions such as the energy available and the communications bandwidth required. However, to ease communication and cooperation, general practices and standards are required.

C) Detection: In dynamic environments, suitable services for things must be automatically identified, which requires appropriate semantic [7] means of explaining their functionality. Users will want to receive product-related information, and will want to use search engines that can find things or provide information about an object's state.

d) Software complexity: Although the software systems in smart objects will have to function with minimal resources, as in traditional embedded systems, an extensive software infrastructure will be needed on the network and on background servers in order to control the smart objects and provide services to support them.

e) *Data volumes*: While some application will involve brief communication, others, such as sensor networks, large-scale “real-world awareness” scenarios, will involve huge volumes of data on central network nodes.

f) *Data interpretation*: To support the users of smart things, we would want to interpret the local context determined by sensors [25] as accurately as possible.

g) *Security and individual privacy*: In addition to the security and protection aspects of the Internet, other requirements would also be important in an Internet of Things. At times we might want to give selective access to certain services, or prevent them from communicating with other things. Ex. Business transactions involving smart objects would need to be protected from competitors’ prying eyes.

h) *Fault tolerance*: Structuring an Internet of Things in a robust and trustworthy manner would require redundancy on several levels and an ability to automatically adapt to changed conditions since we want to rely on things functioning properly [28].

i) *Power supply*: Things typically move around and are not connected to a power supply, so their smartness needs to be powered from a self-sufficient energy source. Unfortunately, battery technology is making relatively slow progress, and “energy harvesting”, i.e. generating electricity from the environment (using temperature differences, vibrations, air currents, light, etc.), is not yet powerful enough to meet the energy requirements of current electronic systems in many application scenarios. Hopes are pinned on future low-power processors and communications units for embedded systems that can function with significantly less energy. Energy saving is a factor not only in hardware and system architecture, but also in software, for example the implementation of protocol stacks, where every single transmission byte will have to justify its existence. There are already some battery-free wireless sensors that can transmit their readings a distance of a few meters. Like RFID systems [22], they obtain the power they require either remotely or from the measuring process itself, for example by using piezoelectric or electric materials for pressure and temperature measurements.

D. Connectivity Challenges

The biggest challenge lies in connection of more number of devices, and it will challenge the very structure of current communication models and the fundamental technologies. At present we rely on the centralized, server/client paradigm to authenticate, authorize and connect different nodes [19] in a network. This model is sufficient for only for present IoT ecosystems, where tens, hundreds or even thousands of devices are engaged. But when networks grow to join billions and hundreds of billions of devices, centralized brokered systems will turn into a bottleneck. Such systems will require large investments and spending in maintaining cloud servers that can handle such large amounts of information exchange, and entire systems can go down if the server becomes

unavailable. The future of IoT will very much have to rely on decentralizing IoT networks. Part of it can become possible by moving functionality to the edge, such as using fog computing models [18] where smart devices such as IoT hubs take charge of time-critical operations and cloud servers take care of gathering data of and analytical responsibilities.

Other solutions involve the use of peer-to-peer communications, where devices identify and authenticate each other directly and exchange information without the involvement of a broker. Networks will be created in meshes with no single point of failure. This model will have its own set of challenges, especially from a security perspective, but these challenges can be met with some of the emerging IoT technologies such as the Phantom protocol, or leveraging the success of other tried and tested models such as the block chain.

E. Compatibility and Longevity Challenges

As an industry that is going through its baby steps, IoT is growing in many different directions, with many different technologies competing to become the standard. For instance, we currently have ZigBee, Z-Wave, Wi-Fi, Bluetooth and Bluetooth Low Energy (BTLE) all vying to become the dominant transport mechanism between devices and hubs. This will cause difficulties and require the deployment of extra hardware and software when connecting devices. Other compatibility issues stem from non-unified cloud services, lack of standardized M2M protocols and diversities in firmware and operating systems among IoT devices [23].

Some of these technologies [20] will eventually become obsolete in the next few years, effectively rendering the devices implementing them useless. This is especially important, since in contrast to generic computing devices which have a lifespan of a few years, IoT appliances (such as smart fridges or TVs) tend to remain in service for much longer, and should be able to function even if their manufacturer goes out of service.

VII. APPLICATIONS OF IoT

The applications of IoT in environmental monitoring are broad: environmental protection, extreme weather monitoring, water safety, endangered species protection, commercial farming, and more. In these applications, sensors detect and measure every type of environmental change. Present monitoring technology for air and water safety mainly uses manual labor along with advanced instruments, and lab processing. IoT improves this technology by decreasing the need for human labor, allowing frequent sampling, increasing the range of sampling and monitoring [12], allowing sophisticated testing on-site and joining response efforts to detection systems. New IoT advances promise more fine-grained data, better accuracy, and flexibility. Effective forecasting [8] requires high detail and flexibility in range, instrument type, and deployment. This allows early detection

and early responses to prevent loss of life and property. Today's sophisticated commercial farms have exploited advanced technology and biotechnology for quite some time, however, IoT introduces more access to deeper automation and analysis. Much of commercial farming, like weather monitoring, suffers from a lack of precision and requires human work in the area of monitoring [21].

VIII. CONCLUSIONS

The foremost highlighting of this paper was to underline major issues in security of IoT predominantly, meeting point the security attacks and their solutions. Concession security mechanism in IoT devices, finished many devices objective for hackers. In this paper, the security necessities are discussed such as confidentiality, integrity, and authentication, etc. Trust in mind the significance of security in IoT environment, it is really very important to include security method in IoT devices and communication networks. Moreover, to protect from any security threat, it is also recommended not to use default passwords for the devices and read the security requirements for the devices before using it for the first time. Disabling the features that are not used may decrease the chances of security attacks. Moreover, it is important to study different security protocols used in IoT devices and networks.

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GPU Parallel Computing of Support Vector Machines as applied to Intrusion Detection System

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Abstract—The network anomaly detection technology based on support vector machine (SVM) can efficiently detect unknown attacks or variants of known attacks. However, it cannot be used for detection of large-scale intrusion scenarios due to the demand of computational time. The graphics processing unit (GPU) has the characteristics of multi-threads and powerful parallel processing capability. Hence Parallel computing framework is used to accelerate the SVM-based classification.

Keywords— support vector machine, parallel computing, graphics processing unit, intrusion detection system.

I. INTRODUCTION

An intrusion detection system (IDS) is a device or software application that monitors a network or systems for malicious activity or policy violations. Intrusion Detection Systems (IDS) have become a standard component in network security infrastructures. An IDS gathers information from various areas within a computer or a network. A survey of the literature available indicates that using supervised machine learning approach this gathered information can be analysed to identify possible security breaches, which include both intrusions (attacks from outside the organization) and misuse (attacks from within the organization). In machine learning, IDS can be viewed as classic classification problem, where given machine learning model predicts if given state is attack or not.

Supervised learning uses the gathered information as training data and produces a model which is a function that if given input to then produces required output. A Classification algorithm is a procedure for selecting a hypothesis from a set of alternatives that best fits a set of observations, in this case the alternatives will be attack or not.

A Support Vector Machine (SVM) is a discriminative classifier formally defined by a separating hyper plane. In other words, given labelled training data (supervised learning), the algorithm outputs an optimal hyper plane which categorizes new examples. SVM is very powerful classifier for handling large datasets in high dimensional space with a strong mathematical property that is quadratic optimization problem. However, it has high computational cost. Thus, this results into more training time for large datasets.

To reduce this training time one of the approaches can be parallel computing with graphics processing unit (GPU). Nowadays GPU are popular for machine learning. A new area has emerged due to highly parallel nature of GPU, known as general purpose computing with GPU (GPGPU). With GPU, parallel computing can be achieved with low cost and low power consumption.

SVM problem is known as quadratic optimization problem. Sequential minimal optimization (SMO) is an iterative algorithm for solving this optimization problem. This paper describes a parallel sequential minimal optimization (SMO) algorithm which solves the SVM problem using GPU for IDS.

II. RELATED WORK

The network anomaly detection technology based on SVM can efficiently detect unknown attacks or variants of known attacks, however, it cannot be used for detection of large-scale intrusion scenarios due to the demand of computational time. The graphics processing unit (GPU) has the characteristics of multi-threads and powerful parallel processing capability. Based on the system structure and parallel computation framework of GPU, a parallel algorithm of SVM, named GSVM, is proposed in this paper. Extensive experiments were carried out on KDD99 and other large-scale datasets, the results showed that GSVM significantly improves the efficiency of intrusion detection, while retaining detection performance [2].

SVM is considered as one of the most powerful classifiers for hyperspectral remote sensing images. However, it has high computational cost. In this paper, a novel two-level parallel computing framework to accelerate the SVM-based classification by utilizing CUDA and OpenMP, is proposed. For a binary SVM classifier, the kernel function is optimized on GPU, and then a second-order working set selection (WSS) procedure is employed and optimized especially for GPU to reduce the cost of communication between GPU and host. In addition to the parallel binary SVM classifier on GPU as data processing level parallelization, a multiclass SVM is addressed by a “one-against-one” approach in OpenMP, and several binary SVM classifiers are run simultaneously to conduct task-level parallelization [1].

SMO is one popular algorithm for training SVM, but it still requires a large amount of computation time for solving large

size problems. This paper proposes one parallel implementation of SMO for training SVM. The parallel SMO is developed using message passing interface (MPI). Specifically, the parallel SMO first partitions the entire training data set into smaller subsets and then simultaneously runs multiple CPU processors to deal with each of the partitioned data sets. Experiments based on this approach show that there is great speed up on different datasets when many processors are used. [3]

Training a support vector machine requires the solution of a very large quadratic programming (QP) optimization problem. SMO breaks this large QP problem into a series of smallest possible QP problems. These small QP problems are solved analytically, which avoids using a time-consuming numerical QP optimization as an inner loop. The amount of memory required for SMO is linear in the training set size, which allows SMO to handle very large training sets. Since matrix computation is avoided, SMO scales somewhere between linear and quadratic in the training set size for various test problems, while the standard chunking SVM algorithm scales somewhere between linear and cubic in the training set size. SMO's computation time is dominated by SVM evaluation, hence SMO is fastest for linear SVMs and sparse data sets. On real world sparse data sets, SMO can be more than 1000 times faster than the chunking algorithm [8].

The scaling of serial algorithms cannot rely on the improvement of CPUs anymore. The performance of classical Support Vector Machine (SVM) implementation—ns has reached its limit and the arrival of the multi core era requires these algorithms to adapt to a new parallel scenario. GPUs have arisen as high-performance platforms to implement data parallel algorithms. In this paper, it is described how a native implementation of a multiclass classifier based on SVMs can map its inherent degrees of parallelism to the GPU programming model and efficiently use its computational throughput. Empirical results show that the training and classification time of the algorithm can be reduced an order of magnitude compared to a classical multiclass solver, LIBSVM, while guaranteeing the same accuracy [5].

III. METHODOLOGY

The binary SVM training step is to solve a typical convex optimization problem, and is usually addressed by the SMO algorithm. The SMO algorithm is mainly composed of a WSS procedure and an optimality function updating procedure. [1]

In this procedure [1], the second-order WSS procedure is used to obtain a two-element working set $B = \{i_{low}, i_{high}\}$. B is selected from the following subset of training points:

$$I_{up}(\alpha) = \{i / \alpha_i < C, y_i = 1 \text{ or } \alpha_i > 0, y_i = -1\}$$

$$I_{low}(\alpha) = \{i / \alpha_i < C, y_i = -1 \text{ or } \alpha_i > 0, y_i = 1\}$$

where C is a constant in the process. To minimize the optimality function f , the working set B is selected to satisfy the following conditions:

$$i_{low} = \arg \max_i \{-y_i f_i \mid i \in I_{up}(\alpha)\}$$

$$i_{high} = \arg \min_i \left\{ -\frac{d_{it}^2}{q(x_i, x_t)} \mid t \in I_{low}(\alpha), -y_t f_t < y_i f_i \right\}$$

where d_{it}^2 and $q(x_i, x_t)$ are defined as

$$d_{it} = -y_i f_i + y_t f_t > 0$$

$$q(x_i, x_t) = \phi(x_i, x_i) + \phi(x_t, x_t) - 2\phi(x_i, x_t)$$

After the working set is selected, the optimality function f is updated. This procedure iterates until the algorithm converges, and the terminating condition is defined as:

$$m(\alpha) - M(\alpha) \leq \varepsilon$$

Where ε is constant, $m(\alpha)$ and $M(\alpha)$ are defined as:

$$m(\alpha) = \max\{-y_i f_i\}, i \in I_{up}(\alpha)$$

$$M(\alpha) = \min\{-y_i f_i\}, i \in I_{low}(\alpha)$$

Finding the minimum and maximum for the convergence condition can be done using parallel reduction shown in figure Fig 1

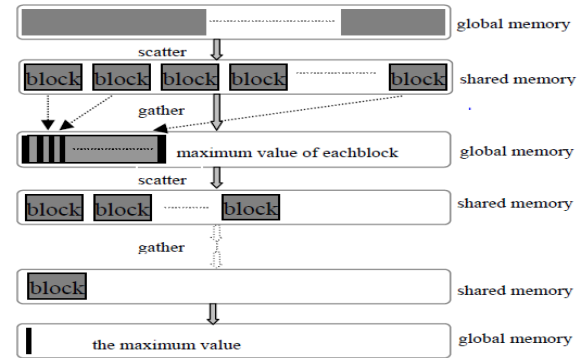


Fig 1 Finding maximum using parallel reduction

As parallel reduction works best for finding the value and not for finding the index for the value. Hence i_{low} and i_{high} are calculated in CPU itself. But some kernel computations required for i_{high} can be parallelized. The overall flow for the algorithm is shown in Fig 2.

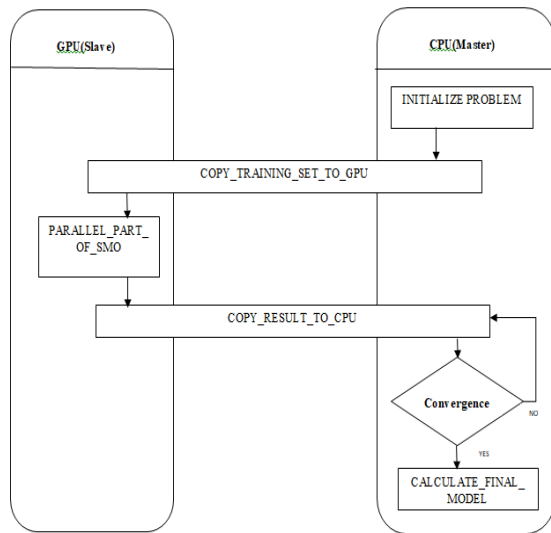


Fig 2. Flow of Algorithm

Parallel SMO Algorithm is as follows

- 1) $\alpha_i \leq 0, f_i \leftarrow -y_i, \forall i \in \{1, 2, \dots, n\}$, and $m(\alpha) \leftarrow 0, M(\alpha) \leftarrow 0$
- 2) copy α and f to device memory
- 3) copy x to device memory, and transpose this matrix
- 4) While $m(\alpha) - M(\alpha) > \epsilon$
do
Working set selection:
In host calculate i_{low}, i_{high}
obtain $m(\alpha)$ by reduction in the device
calculate $\phi(x_{ilow}, x_i)$ for each sample in the device
obtain $M(\alpha)$ by reduction in the device
copy $m(\alpha)$ and $M(\alpha)$ to host
Update: check if $m(\alpha) - M(\alpha) > \epsilon$ in host:
execute: Updating old values of α and f
End while

IV. RESULTS AND ANALYSIS

A. Dataset and Platform

Dataset used is KDD Cup 1999 Data 10% subset. This dataset is collected over a period of nine weeks for a LAN simulating a typical U.S. Air Force LAN. It contains 24 types of attacks and 41 features. As this is binary classification, data is pre-processed and converted into numeric and normalized form with all attacks labelled as -1 and normal records as +1. The experiment was carried out on workstation with Intel Xeon E5 v2 CPU at 2.5GHz and 8GB of RAM, running Ubuntu and the GPU used is NVIDIA® Tesla® K80

B. Experimental Results

Sequential SVM is implemented in Python whereas parallel SVM is implemented in PyCUDA. In parallel SVM block size in CUDA is an important factor related to performance of the algorithm. TABLE I describes training time by parallel SVM for given number of samples for block size values 128, 256, 512, 1024. For this experiment the standard parameter for

SVM classifier max_iter is 50. Fig 3 represents graph for TABLE I. TABLE II and TABLE III represents training time required for both sequential and parallel algorithm. For observations in TABLE II the standard parameters for SVM classifier are default values that is $C=1.0$, $\epsilon=0.001$, max_iter=1000 with linear kernel. This particular configuration is called as SET I. For observations in TABLE III, all the parameters are same as TABLE II except ϵ is kept as 0.01. This particular configuration is called as SET II. For both the SET I and SET II the training datasets used are same just the parameters are different as mentioned above. The graph is plotted for SET I that is for all observations in TABLE II. Fig 4 represents this graph for the observations in TABLE II. It shows the particular behaviour for sequential and parallel algorithm.

TABLE I
TRAINING TIME FOR DIFFERENT BLOCK SIZE

Number of samples	Training Time (s)			
	blocksize=128	blocksize=256	blocksize=512	blocksize=1024
7000	8.32	8.24	8.11	8.67
10000	10.18	10.20	9.88	10.28
20000	21.14	21.33	20.14	22.67
40000	39.89	39.48	38.67	40.92
60000	57.23	57.78	55.21	58.49
80000	80.19	81.85	77.68	85.90
100000	95.72	96.93	93.79	97.38
200000	192.90	207.90	186.85	193.60

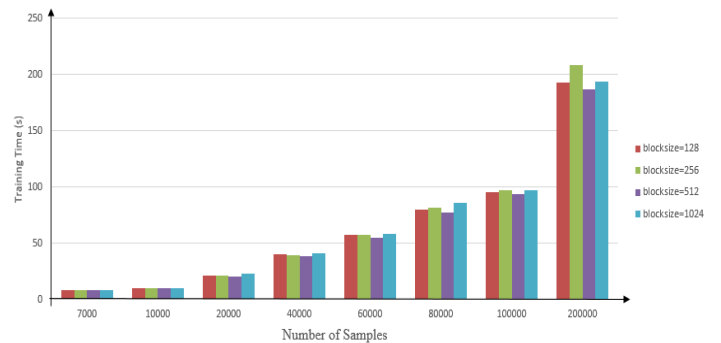


Fig 3. Training Time for different block size

TABLE III
TRAINING TIME FOR ALGORITHMS SET I

Number of samples	Training Time (s)		Speed up
	Sequential SVM	Parallel SVM	
10000	77.28	72.04	1.07
20000	101.32	80.37	1.26
40000	220.23	156.14	1.41

60000	478.75	304.68	1.57
80000	629.88	390.15	1.61
100000	998.71	550.66	1.81
200000	1490.47	730.04	2.04

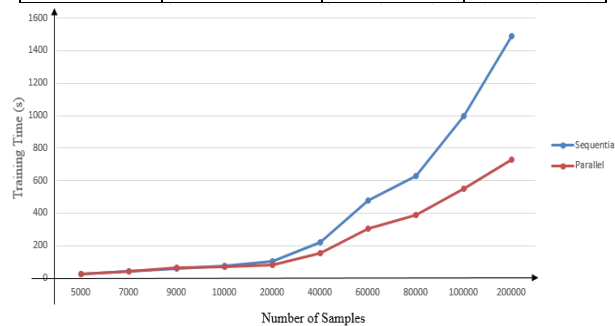


Fig 4. Training Time for algorithms SET I

TABLE III
TRAINING TIME FOR ALGORITHMS SET II

Number of samples	Training Time (s)		Speed up
	Sequential SVM	Parallel SVM	
10000	73.48	69.2	1.06
20000	98.22	77.29	1.27
40000	202.33	140.32	1.44
60000	430.12	280.97	1.53
80000	610.35	374.33	1.63
100000	980.18	530.74	1.84
200000	1444.58	690.91	2.09

C. Analysis of Results

With TABLE I and Fig 3, we can see that training time for block size 512 is minimum for all training sample size. It is concluded that for the given configuration of system 512 block size is more suitable. Even with block size 1024 training time is more than other block size values for parallel algorithm. For CUDA the maximum block size used is 1024 that is why at the boundary value system does not show its best performance, as too much of resources are used. With less values of block size the, resources are underused. For the choice of block size GPU family that is also the architecture plays an important role.

It can be seen with graph in Fig 4 that training time for sequential SVM increases rapidly with increase in number of samples. Whereas for parallel algorithm the training time increases gradually with increase in number of samples. We can see that up to training sample size 10,000 the time required by both the algorithm is somewhat similar with sequential algorithm taking less time than parallel algorithm. After size 10,000 is crossed speedup increases rapidly as the number of training samples increases with parallel algorithm taking less time than sequential algorithm. We can see low speed up for small values of number of training samples. This is a typical behaviour for parallel algorithm. For less number

of records the cost of parallelism that is transferring data from CPU to GPU and then again back to CPU is more than the benefit due to parallel processing.

By analysing observations in tables TABLE I and TABLE II, we can see that when the threshold value, known as epsilon, is increased then both the sequential and parallel algorithm converges sooner. In this case also after size 10,000 is crossed speedup increases rapidly as the number of training samples increases with parallel algorithm taking less time than sequential algorithm.

With dataset divided into 70% training and 30% testing datasets, both sequential SVM and parallel SVM classifier, show 98.99% accuracy. The maximum training size used for the given experiment is 2 lakhs. Only 10 percent of KDD CUP dataset contains more than 4 lakh records. As we can see more benefit in terms of speedup with increase in number of samples, this approach is more beneficial for whole dataset as training dataset.

V. CONCLUSION

SVM is a powerful classifier with high computational cost. The computational cost increases with increase in sample size. The emergence of GPUs as massively parallel processors has opened a wide range of opportunities for acceleration of large-scale classification problems. The data-parallel characteristic of many learning algorithms like SVM conveniently fits the set of problems that modern GPUs are meant to solve.

In this a paper parallel SVM using GPU for intrusion detection is proposed. Using this approach, we can conclude that with given GPU having compute capability of 2.91 teraflops, achieved maximum speedup is 2.09 with accuracy 98.99%. This speedup can be further increased for given number of training samples by using GPUs having more compute capability.

This approach can be further extended for multi classification by exploiting parallelism related to both CPUs and GPUs. Also, this approach can be more beneficial with more complex datasets.

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Design and Modeling with Autodesk 3DS Max

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Abstract

Digitization is one the way by which heritage and important places, sits, things, statues, objects, etc. can be prevented from degradation. There are many software's available in market for the modeling of objects but in this study Autodesk 3DS Max was used for modeling the objects used by Dr. Babasaheb Ambedkar which are preserved in Milind College of Arts and Science in Aurangabad, India.

1. Introduction

A process of creating 3D model from 2D pictures is known as 3D Modeling. 3D models are the 3D representation of objects through specializes computer graphics software's. 3D models can be generated either manually or automatically. 3D scanners are required for the automatic creation of 3D model and 2D pictures can be used for manual creation of model. Mostly manual way is adopted for creating 3D models so that once created object can be used in another project.

3D modeling has benefited many fields such as industry, entertainment, advertisement, media, teaching, archaeologist, civil engineers, gaming, animation, etc. [3] more over 3D modeling has benefited a lot in preserving and protecting heritage and important sites and objects. These models are created with the help of specialised 3D modellers. There are many 3D models present in the current era, such as Computer-Aided Design (CAD), Shetchup Pro, PhotoModeler, MeshLab, Autodesk 3DS Max etc. [1]. This study is carried out by using Autodesk 3DS Max 3D modeling software using manual method of creating models.

Autodesk 3DS max was selected as a 3D model in this case study. Max is a powerful tool capable of working with complex designs. It is used by developers for making animations, developing games, visual effect artists, modelling, rendering, lifelike models, etc. Along with the creation of model Texturing can be done in Max which is a very essential and time consuming process but a lot of time is saved if Max is used for texturing. Max supports the features as perspective matching, vector map support 2D pan and zoom.

2. Literature Review

One of the major benefits of 3D modelling is that it is used for preserving the heritage/important sites. It is witnessed that countries are making the use of 3D modeling for preventing these heritage/important sites. Moreover UNESCO (United Nations Educational, Scientific and Cultural Organization) has also marked more than 1073 heritage sites in the world. Countries such as Italy, Turkey, Netherlands, Mexico, Nepal, European, Bulgaria, Norway, Canada, Germany, Spain, India etc. A lot of work is also done in India [1].

For the creation of 3D models, many researchers have made the use of Photogrammetry technique. The method or techniques used for creation can be classified as an Image Based Method (Passive Technique) and Range Based Method (Active Technique). Again, these Photogrammetry techniques based on the camera distance can be categorized as Far Range Photogrammetry and Close Range Photogrammetry.

Many different tools and techniques were adopted for creating the model [1]. Different counties have adopted different tools to create 3D models such as Sketchup Pro [14, 16, 19, 21], CAD [2, 5, 6, 10, 17, 20], ArcGIS [6, 7, 8, 9, 13, 21], Photomodeller [11, 18], Maya [10, 12, 15, 16, 19], etc. all these tools were used to model the important and heritage sites.

Besides these available softwares 3DS max is also used for 3D modelling. There are many companies which at very fast speed are developing fairly good 3D software's, Autodesk is one among them. This tool is capable of dealing with complex structures. The tool can not only be used for creating 3D models of heritage or important sits but can be used for development and creation of city [22], car, etc. and 3D animations are also prepared. Max is used for 3D modeling, 3D Animation and 3D Rendering. The software is available in 40 different languages. Lifelike models are created in Audodesk 3DS Max. Detailed Texturing of the objects can be within a very less

time. Many additional different renders are also provided by Autodesk. 3D models and textures can be moved from one Autodesk products to another. Models created in other products apart from Autodesk can be imported and used, even manipulations of those models is also possible. The environment of the tool is user friendly and can also detail with complex animations such as games, cartoons, movies, etc. along with all these features a very large amount of tools are provided for modeling the objects. Along with 3D models, rendering and animations walk-through can be created. Due to all these features Autodesk 3DS Max is becoming more popular now a day and is one of the most used product.

3. Methodology

On the way to construct a 3D model of an object some essential steps should be followed. By following these steps 3D model of any object can be created.

- Data Acquisition
- Making of 3D Model

3.1. Data Acquisition

The first step to create 3D model is Data Acquisition. Acquired data may be may be either a hard copy picture captured from a film camera or a digital image capture with a digital camera. If the data is in the hardcopy pictures format it needs to be first scanned and convert into a digital image. To make digital images from a hard copy picture a high resolution scanner is needed and then the picture can be used as a digital image. To obtain high resolution images high resolution camera is needed. To avoid this scanning process and obtain high details of the object, in this study Close-Range photogrammetry is used as a digital image. Close-Range photogrammetry is becoming more popular now a days not only because it provides high details of the object but due to its economic aspect. As the price of the device used to capture the picture is low and no amount is needed for developing the picture, any number of pictures (digital images) can be captured among which best can be selected [2].

In this case study Sony ILCA-68 DSLR camera is used to capture the images. The camera has a sensor APS-C type (2.3 x 15.6mm) Exmor® CMOS sensor with a focal range EV-2 to 18 (at ISO 100 equivalent). Photographs of the objects and the Dome (the place where these objects are kept) are taken and are preserved in Milind College. At least two images of each object were captured. Data Acquisition was completed at day time, so maximum images were captured without making the use of flash only two or three objects, pictures were clicked with flash which was needed to obtain clear flash.

3.2. Making of 3D Model

To make 3D models of any object it is needed to have certain procedure. By embracing this flow any model can be created.

- Modeling object
- Texturing
- Rendering

3.2.1. Modeling object

Construction of a 3D model is the most important part and can be accomplished through different software's. In this study Autodesk 3DS Max 2014 is used for generation of 3D models. Producing 3D objects in 3DS Max is a complicated process for which basic polygon modelling knowledge is required. The polygon modelling is used for representing the objects. 3DS Max provides many basic shapes for modeling the objects such as Geometric shapes, Architectural objects, Shapes, compound objects, system, etc. These shapes need to modify in such a way that the desired shape and structure is achieved and for which 3DS Max provides an object-space modifiers. These modifiers directly affects the geometry of the object. There are many modifiers in the 3DS Max such as bend, bevel, bevel profile, chamfer, edit poly, edit spline, extrude, lathe, melt, mesh select, mesh smooth, push, shell, skew, smooth, taper, tube smooth, twist, cloth, hair and fur, FFD (Free – Form deformation) etc.

To model any complex construction object reference image is the first requirement. Instead of having a reference the image outside the model environment, it's better to have images within the viewport. There are two

different ways through which reference image can be setup in the viewport and any one way can be adopted as per the need and requirement.

- a. Materials or Planes
- b. Background Images

a. Materials or Planes

In this method one the reference image material is applied to the geometric shapes. To create a model with proper views it is needed to have at least two pictures of an object, one from the front and another from the left or right side (or both) or top or bottom of the object. As per the images the number of planes is taken for reference. In this method one should have the same size of all the pictures of a particular picture, for example 1024x1024 is the size of front image same must be of another that is a ratio of image size must be 1:1. If the ratio doesn't same, then it result in the appearance of the created object. This method appears somehow it is shown in the figure 1 below.

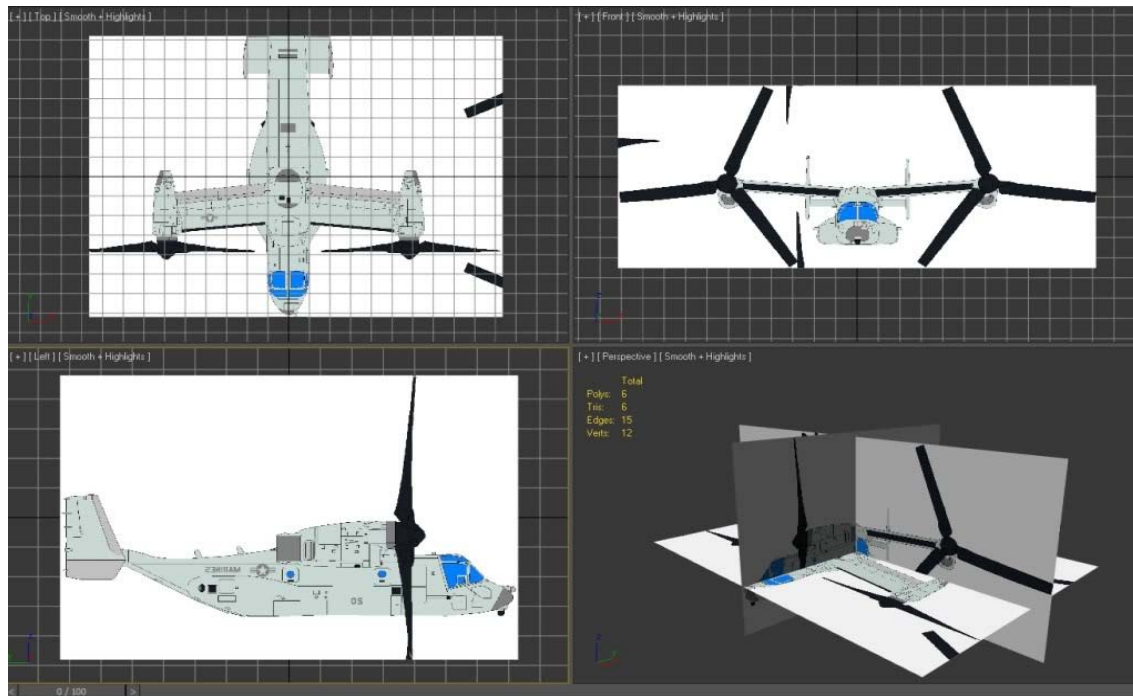


Figure 1: References through Plane setup environment [6]

b. Background Images

In this method multiple images of one objects is not required. The image to any size and resolution can be used. A useful method for creating 3D models if only one picture present. The image is set in the background of the viewport and background image zoomed in and out as the viewport is zooms in and out. This method is more wrathful while working with Shapes such as line, circle, etc. In this method background image can display in one viewport or in all viewport as per our requirement. The figure 2 illustrates the example for background image.

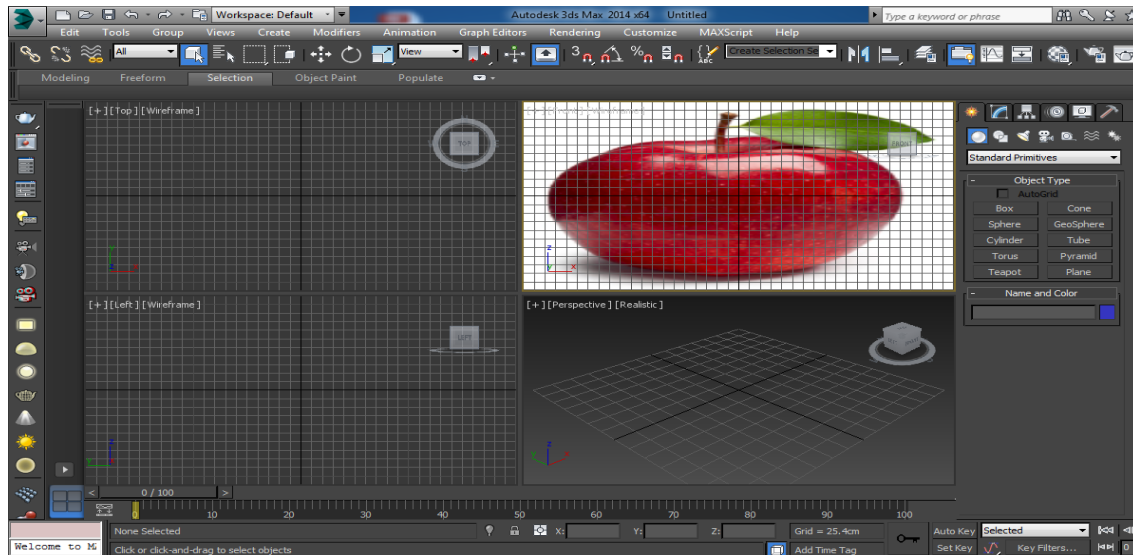


Figure 2: References through background image setup environment

3.2.2. Texturing

Texturing is one of the most important and essential step in 3D modelling and is supported by Autodesk 3DS Max. Texturing refers to the characteristics of the surface and can be described as smooth or rough, glossy, hard or soft etc. Texture produces the visual the visual impression to human observation, such as color, orientation, intensity, etc. Texture can be created with the help of many software such as Photoshop, Granite, Substance Designer 4, Z Brush 4, Mari, paint, etc. Texturing can be done in 3DS Max with the help of Material edition. Material Editor have a feature named as Bitmap which help to even import the image file in the max and this image can be applied as texture to the object. Apart from which it also provides the setting by using glossiness, smoothness, reflection, refraction, etc. can also be provided to object, which gives the realistic view of the object.

3.2.3. Rendering

A process where a 3D seen is converted to 2D image is called as Rendering. Rendering is the last step in 3D model generation and a very essential step. The 3D data present in a file is passed for rendering after which the output obtained is a digital image. For rendering an image many other renders are also available other than a default renders. This process of rendering can be done by using V-Ray, Mental Ray, Iray, Scanline, Maxwell, Corona, Octane, LuxRender etc. different results are obtained from different rendering software [3]. Rendering of the object can be done multiple time and can be done till the desired output is obtained.

4. Selected field

In the year 1945 Bharat Ratna Dr. Babasaheb Ambedkar established Peoples Education Society in Mumbai having a network of several educational institutes of higher education in Maharashtra, Karnataka and Bihar. He sensed that education is a solution to liberate people the age old slavery, which became the mission of his life with this trust the Peoples Education Society was established. He observed that as Aurangabad holds an excessive number of cultural heritage monuments, due to which this region was denied for years from education. Looking at the fact the society selected Aurangabad and established Milind Mahavidyalaya in Aurangabad as first graduate college in the Marathwada Region in the year 1950 [4].

Aimed at the establishment of Milind Mahavidyalaya Dr. Ambedkar arrived Aurangabad and remained in Aurangabad for a period of time. During which some household items used by him are present till now and are preserved by Milind Mahavidyalaya. Objects preserved in the Dome of Milind Mahavidyalaya are chairs, bed, handkerchief and towels, sticks, sink and some kitchen utensils.

The purpose behind this study is to preserve these objects having national importance. To preserve these objects for future is to create a 3D model of the object and for which Autodesk 3DS Max 2014 is used. 3D model of the objects and Dome present in Milind Mahavidyalaya are made.



Figure 3: Dr. Ambedkar with the architect of Milind College (Aurangabad) with Principle M. B. Chitnis, Savita Ambedkar, Rao Bahadur C. K. Bole and B. H. Varate [5]

5. Experimentation and Result

In this study many different objects are constructed in the 3D model form. For creating every object in the 3DS Max method is adopted. The objects modelled by using Max are detailed below.

5.1. Dome

The dome is the place in Milind Mahavidyalaya where the objects used by Dr. B. Ambedkar is prevented. To create the 3D model of the dome beneath steps was adopted.

- Modeling object

In need of creating the 3D model of Dome Geometric shapes as sphere, cylinder, cone and tube were used. Sphere was utilised as the light present on the dome. The cylinder was used to create rod and the design below the light. With another sphere the big curve was designed and for doing that the object was converted into editable poly and desired structure is given. The remaining body of the dome was created using the cylinder. Roof of the object was created with cone. Next window where create with box as bored, plane as the background and cylinder as rods, all were grouped together and two more copies of the created window where maid and placed on dome. Door was created by modifying box. The box was converted to editable poly and with the extrude option design on the door was made. The handle and Latch (Kundi) of the door where made by modifying the cylinder and box by applying bend modifier to provide the desired structure. As the door is square and dome is round, so fit the door to the dome in a proper way FFD 4x4x4 modifier is used. The box was utilized to create the boundary beside the dome. The grill beside the dome was made from plane and box. At least the plane was used for making the floor and sky.

- Texturing

Texturing of the dome and the wall was made with the Material Editor tool present in Max software. By using the Ambient option in editor window default blue and white color shade was used. The door, windows, sky, floor and the grill images where imported using defuse option and where applied to the object to obtain the textures.

- Rendering

The created object was rendered by using default Render Production. The view of the object was tested and rendered multiple times and the desired result is shown in the figure 4.

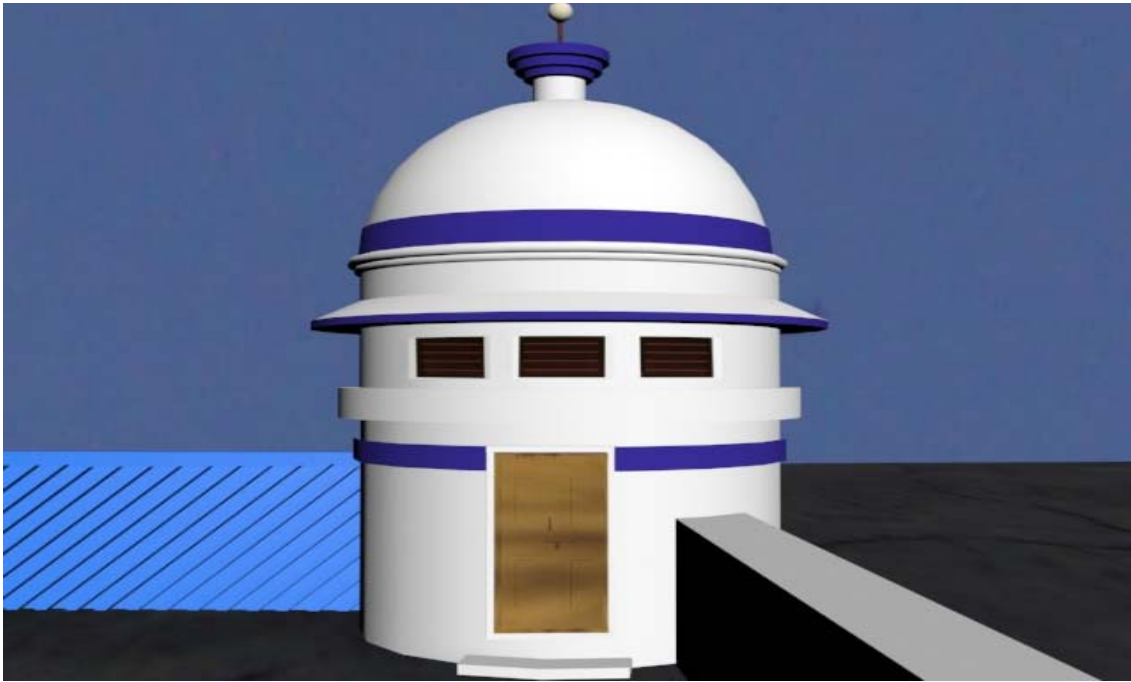


Figure 4: Dome

5.2. Chairs

There are four different style chairs which are where used by Dr. Babasaheb Ambedkar in his day-to-day use. All these chairs were constructed by using a very different way as the structure of all of them are different.

- Sitting Chair
- Modeling object

To create a chair of such a type as shown in the figure first a box was taken and Edit Poly modifier was applied to convert the box to editable poly. By deleting the some polygons and by extruding some polygon the chair can be designed. Another box is modelled to create the backrest of the chair and was placed on the chair. Hand rest of the chair was created by again modeling a box. FFD 3x3x3 modifier is applied to the chair for slightly bending the chair arms as it is seen in the figure. Mat on the chair is created by placing the box in such a way that it forms the design of the chair. Text shape was used to write the text present on the chair.

- Texturing

Texturing of chair was done by applying by importing the wooden textured image by using diffuse option present in Material Editor Tool and text and mat was textured as default white colour from ambient option in Material Editor Tool.

- Rendering

Many times rendering was made by the chair with default Render Production till the satisfying result is obtained. Satisfying result means till the time desired angle and position of the object is not obtained. The output of this creation is presented in the figure 5.



Figure 5: Sitting Chair

- Reasting Chair
- Modeling object

The chair was modelled by applying edit poly modifier to the box by deleting certain polygons and extruding some. For creating the armrest of the chair reference image was set by using the background image method. The arms were designed using the line shape and bevel modifier was used to provide thickness of the line and increase the width segments till the required thickness is obtained. The copy is created of the obtained shape and both arms are placed on the chair. The box is modelled and copied for creating the sticks present on both sides of the chair. Mat was created by combining the boxes together and was joined by the chair.

- Texturing

Chair was texture by applying wooden textured image through the Material Editor Tool and white color was applied to the mat

- Rendering

Rendering of the chair was done by default Render Production and the obtained product is shown in the figure 6.



Figure 6: Resting Chair

- Upholstered Swivel Chair
- Modeling object

The box is modelled to create the base of the chair. Another box was modelled for creating the backrest of the chair. Background image method was used and reference image was set up. Line shape is used for creating the legs and the hand rest of the chair. Bevel modifier is applied on the line shape and outline width is increased to obtain the thickness to shape. By placing the boxes mat of the base of the chair is created. Pillow at the backrest of a chair is created by applying the cloth modifier to the box and increase the pressure according to the thickness of the pillow and simulate the box. The pillow is ready and place it at the backrest of the chair.

- Texturing

Texturing was made with Material Editor Tool. Wooden texture image is applied to a chair, pillow color textured image was used for pillow and white color is applied to the mat.

- Rendering

Default render was used and the chair was modelled which is shown in the figure 7 below.



Figure 7: Upholstered Swivel Chair

- Wooden Folding Chair
- Modeling object

Line shape was used for making the base of the chair and to make the line solid bevel modifier was applied. Then the shape was controlled by applying FFD 3x3x3 modifier. The box was modelled to create the legs and backrest of the chair.

- Texturing

By using Material Editor Tool wood texture was applied to the chair through images.

- Rendering

Default Render Production was used for rendering the chair and is illustrated in the figure 8 below.



Figure 8: Wooden Folding Chair

5.3. Bed

The bed was used for resting and design is of an old antique pattern.

- Modeling object

The box was converted to editable poly and was molded to form a bed. Camferbox was made as a mattress of bed. Two planes were placed on one above the other to create mattress cover. Cloth modifier was applied to both planes to form the cover.

- Texturing

By using material editor tool wood texture was given to bed and images of two different textures were applied from the mattress cover.

- Rendering

The resulted model was rendered and the product is shown in the figure 9.



Figure 9: Bed

5.4. Handkerchief and Towel Box

There are some handkerchiefs and towels used by Dr. Ambedkar in that period of time. These handkerchief and towels are stored in the box.

- Modeling object

The box was converted to editable poly and modelled to form box to hold the handkerchief and towels. The cylinder was used to form rods. The box where used to form handkerchief and towels by applying cloth modifier.

- Texturing

Wooden texture was applied to the box. Different textures were applied to handkerchief and towels. Metal texture is applied to rods.

- Rendering

The result of the creation is rendered and is presented below in the figure 10.



Figure 10: Handkerchief and Towel Box

5.5. Stick Box

The three sticks were used and these are kept in a box

- Modeling object

The reference image was set with background method. The cylinder was taken and edit poly modifier was applied to convert it to editable poly which was then modelled and shaped to have a look of the stick. The same procedure was adopted for all sticks. The box was modelled to form the box to hold two sticks.

- Texturing

Three different textures were formed and applied to the three sticks. Wooden texture was applied to the box.

- Rendering

The resulted output was rendered using default render and is shown below in figure 11.



Figure 11: Stick Box

5.6. Sink

The sink is also preserved, which is on the old design pattern of 1950's and used for washing hands.

- Modeling object

The line was used to make the shape of the sink and lathe modifier is applied. With axes the size and structure was designed. The box was modelled to form a table. The sink is placed on the table.

- Texturing

The used sink texture was created and applied to the sink. Wooden texture was applied to the table.

- Rendering

The product was rendered and results is detailed in figure 12.



Figure 12: Sink

5.7. Utensils

There are few utensils used such as Deep Cylindrical Vessel (Bhagona), Deep Cylindrical Vessel (Bhagona), second Plate (Thali), Chapatti Griddle (Tava), Big Bowl (Katora), Chapati Box (Katordaan), Serving Bowl (Katori), Jar, Teapot (Kettle) and Bowl (Katori). All these objects are placed on the table.

➤ Deep Cylindrical Vessel (Bhagona)

This deep cylindrical vessel was used for cooking food. There are three vessels present and all three are created by adopting the same method.

- Modeling object

First the reference image was set in the background. The line was taken and drawn in the shape of the vessel and then lathe modifier is applied to the line with axis option the shape was adjusted and the vessel is obtained.

- Texturing

Metal textured image is applied to the vessel through Material Editor Tool.

- Rendering

The vessel was rendered after applying the texture to check the appearance of the vessel. The result of which is shown in figure 13.

➤ First Plate Lid (Thali)

The lid also known as plate was used for covering the opening of utensils.

- Modeling object

Reference image of plate was set in the background. The plate was created from a line. A line was drawn in the shape of the plate and lathe modifier was applied to it and the lid that is plate is created.

- Texturing

The plate was textured by applying the metal textured through Material Editor Tool.

- Rendering

The plate was rendered to check the appearance and texture.

➤ **Second Plate (Thali)**

This plate was used to eat food.

- Modeling object

Reference image was set in the background. The line was used to create the structure of the plate and lathe modifier was applied and plate was ready.

- Texturing

Textures were created and stored in image form. This created texture was applied to the plate.

- Rendering

The plate was tested by rendering to see whether the appearance is accurate.

➤ **Chapatti Griddle (Tava)**

The griddle is used for roasting the chapatti.

- Modeling object

The background image was set and by applying lathe modifier to line created by the shape of griddle. The griddle is obtained.

- Texturing

The texture of the griddle was created and applied to the griddle.

- Rendering

Created object was rendered for testing the appearance.

➤ **Big Bowl (Katora)**

The Big Bowl might be used for storing the food and used while serving the food.

- Modeling object

The reference image was set in the background and the shape of the bowl was made using the line shape. Modifier names as lathe was applied to get the bowl.

- Texturing

Metal like structure was applied to the bowl.

- Rendering

The object was rendered to view the look of the big bowl.

➤ **Chapatti Box (Katordaan)**

Chapatti Box was used for keeping chapattis and stored for a long time.

- Modeling object

Reference image in the background was taken and by using line, shape the base and cap of the chapatti box were designed. Modifier Lathe was used to provide the solid shape to the object.

- Texturing

On both the object's metal texture was applied.

- Rendering

Chapatti Box was rendered using default render.

➤ **Serving Bowl (Katori)**

Nine serving bowls were stored and can be used for serving gravy, vegetables, dal, sweets etc.

- Modeling object

In the background reference image was taken and by using line and lathe modifier serving bowl was created. After creating one bowl more eight copies of the bowl were made and placed the sequence.

- Texturing

As the serving bowl has the view of metal, metal texture was used.

- Rendering

All bowls were rendered together with default method of rendering.

➤ **Jar**

Jar may be used for storing food items such as pickles.

- Modeling object

Image was setup for reference. The line was used to create the structure of the jar by applying the lathe modifier. The handles of jar were created by using line, shape and applying bevel modifier to it. By making the copy of one handle another is created and are attached to the jar.

- Texturing

Shiny white jar like texture was applied on jar.

- Rendering

Default render was used for rendering.

➤ **Teapot (Kettle)**

Teapot was used for keeping the tea into it. It was used for keeping tea hot for a long time.

- Modeling object

For modeling a complex structure like a teapot reference is required and was set up in the background. A line was drawn in the shape of the body and handle of the teapot and lathe modifier was used. The same procedure was adopted for creating the spout and after which to smooth the design of spout tubesmooth modifier was applied. The lock holding chip of teapot and locks were designed by molding cylinder. All the objects were grouped together so that the shape of teapot do not change while moving.

- Texturing

Used metal texture is applied to teapot.

- Rendering

Rendering was done by default render.

➤ **Bowl (Katori)**

It was used for serving and eating the food.

- Modeling object

Reference background image is used. Line was used to make the object by applying the lathe modifier. Tube was used to make the ring to the bowl and all objects where grouped together. The created object was copied to form another bowl with same size and appearance.

- Texturing

Texture of metal is applied.

- Rendering

Default render is used.

- Modeling object

Cylinder was used for creating the table. All the utensils created were imported and merged together and where placed on the table.

- Texturing

As all the utensils were textured before only the created objects that is table was given the wooden texture.

- Rendering

Rendering was made multiple times so that to obtain the desired view. This rendering is done through default Render Production. The result is demonstrated in the figure.

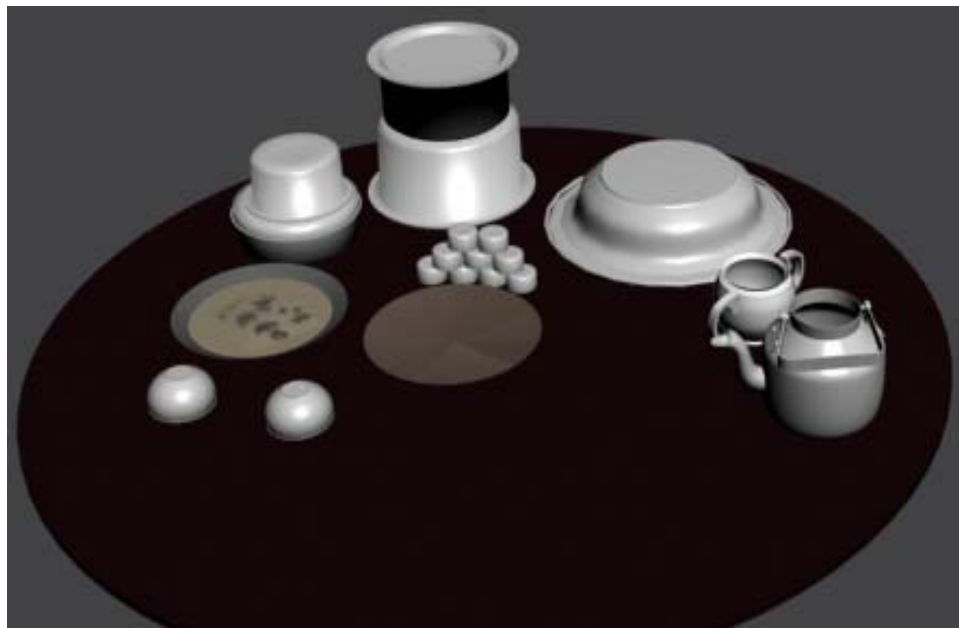


Figure 13: Utensils

6. Discussion and Result

Autodesk 3DS Max was selected for the creation of 3D models because Max results better while working with fine details as compared to Sketchup Pro. Sketchup Pro is the tool basically used for the construction of interior and exterior of the constructions. For modeling the objects in Max solid shapes and lines, both can be used and desired design can be formed. Sketchup Pro deals with lines and do not use organic shapes for modeling the objects which becomes very complicated while having constructing fine detailed objects. With organic shapes or solid shapes it becomes very easy to understand the structures visually rather from the line. Max also provides a lot of modifiers to provide the realistic view of the object.

Different shapes and modifiers were used for the creation of objects. Though the structure of the objects look same but different ways were adopted for the formation. For example, we can look for the chairs. There are four chairs and the process for modelling each chair is different as the structure of every chair is different.

When it comes to the part of Texturing there are many ways through which textures can be applied to the object in Max such as colors and images. Textures can be created as per the need and already created textures can also be applied to the object. In this study textures were created and then applied to the object. In order to get the proper view of the used thing the textures were created. Multiple times the rendering of the object was made to check that the applied textures to the object is giving the desired output or not and the best is selected.

There is rendering process present in both Sketchup Pro and Autodesk 3DS Max but Max also provides many external rendering tool which can be used for speeding up the process of rendering.

7. Conclusion

3D model of important objects used by Dr. Babasaheb Ambedkar is created in this study. The detailed accuracy of the objects was required and hence Autodesk 3DS Max 2014 software was used. For the creation of every object different shapes and modifiers were used. Created textures were used for texture the objects. There are many rendering tools available, but default renders tool is used in this study

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A SECURE STEGANOGRAPHY APPROACH FOR CLOUD DATA USING ANN ALONG WITH PRIVATE KEY EMBEDDING

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Abstract: Cloud computing is a powerful, flexible, cost efficient platform for providing consumer IT services over the Internet. However Cloud Computing has various level of risk because most important information is maintained and managed by third party vendors, which means harder to maintain security for user's data .Steganography is one of the ways to provide security for secret data by inserting in an image or video. In this most of the algorithms are based on the Least Significant Bit (LSB), but the hackers easily detects it embeds directly. An Efficient and secure method of embedding secret message-extracting message into or from color image using Artificial Neural Network will be proposed. The proposed method will be tested, implemented and analyzed for various color images of different sizes and different sizes of secret messages. The performance of the algorithm will be analyzed by calculating various parameters like PSNR, MSE and the results are good compared to existing algorithms.

Keywords: Artificial Neural Network, Steganography, PSNR, MSE

I.INTRODUCTION

In cloud computing environment, maintaining security for data is the one of the vital parameter. For that we have different approaches like cryptography techniques, steganography techniques and watermarking hiding strategies. Still those techniques are suffered with some major problems because data is maintained by a third party from different places at different locations. So it is necessary to have some novel methods which can have the capability to embed the data securely. For this in the proposed algorithm Steganography technique is utilized for maintaining of data secrecy.

Steganography is a technique which can hide the data in an image. The hiding information is any format like audio,video,plain text file. The word Steganography is comes from the Greek words "Stegos" meaning "cover" and "Grafia" meaning "written work" signifying it as "invisible writing". Steganography is a novel technique which is used for hidden message. The proposed technique uses spatial domain environment for embedding secret message into a single cover image using Artificial Neural Networks to enhance the level of security for data. The Organization of the paper is as follows. In section 2 the related work is discusses. In section 3 materials and methods are discussed. In section 4 our proposed method is described. Finally the results are presented in section 5.

II. RELATED WORKS

In Suneetha D et.al's [1] has proposed a new algorithm using LSB based image steganography. In this approach secret data is embed in the combination of pixels. The secrete message is converted into binary is in the form of 0 and 1. For hiding 0 bit use some combination of two bits and for 1 use another combination of bits. Hence it is a typical process for hackers to retrieve the data from a image. Results are provided with high security, good quality in stego image with acceptable PSNR values.

In Kiran Kumar R. et.al [2] has proposed a new technique for embedding secret message. In which first we identify the edge pixels using canny edge detection algorithm. Next we identify the Fibonacci edge pixels from an edge based image. Results are

evaluated and compared with various existing algorithms and identify the improvement in PSNR and MSE Values

In Kiran .R et.al's [3] proposed a novel steganography technique which increases the capability of hiding of data securely. In this approach First read the original cover image then divide the original image into 9 equal parts for storing huge amount of data. Then apply edge detection algorithms and LSB substitution algorithm for each partitions of an cover image to select the secret pixels for data hiding. Later use encryption algorithm to convert original message into cipher text and obtain the key. Finally obtained secret key is hiding in the selected pixels of an image. In this the amount of secret message hiding is gradually increases and it shows a better PSNR values.

In Suneetha .D [4] proposed a new approach in spatial domain environment for hiding secret messages in different parts of a cover image . This method helps to embedding secret data with minimum noise in the cover image.

In Siddharth Singh et.al's [5] has proposed a novel approach using DCT coefficients. In this approach a sequence generator and android transform techniques are used to hiding secret data securely. This algorithm is well suited for JPEG image extension files and it provides better PSNR values and also the image quality is good when compared to other existing algorithms.

In Sadeq AlHamouz et.al's [6] has proposed a new approach based on the neural network concept back propagation. In this approaches two images are used one is secret images and the cover images, both are color images. The algorithm uses two different phases one is data embedding process and other one is data extracting process. The hiding bit positions are calculated using Fibonacci linear feedback shift register. The experimental results are compared with several exciting algorithms that high PSNR value is achieved with good quality of the image and more processing time.

III. MATERIALS AND METHODS

3.1. Artificial neural network approach

In this proposed algorithm we use one of the technique of neural networks i.e. cascaded feed forward neural network along with it Levenberg Marquardt training algorithm. The cascade feed

forward neural networks are similar to feed forward networks. The cascaded feed forward networks consist of several layers. Every layer has a subsequent connection with other layers. The first layer has a connection from the network input. Each and every layer has the connection with the previous layer.

The function newcf is used to create cascade forward networks. For example consider a five layer network which has the connection from one to five layers respectively from one to five and also it have the connection from input layer to all the five layers. The importance of additional layer is to improve the speed of the entire network

IV. PROPOSED METHOD

The proposed method here came to increase the security level, reducing the embedding and extracting time and reducing the noisy level of a cover image after embedding the secret message.

Phase1: Embedding the secret message:

The procedure for data embedding is shown in Figure1.

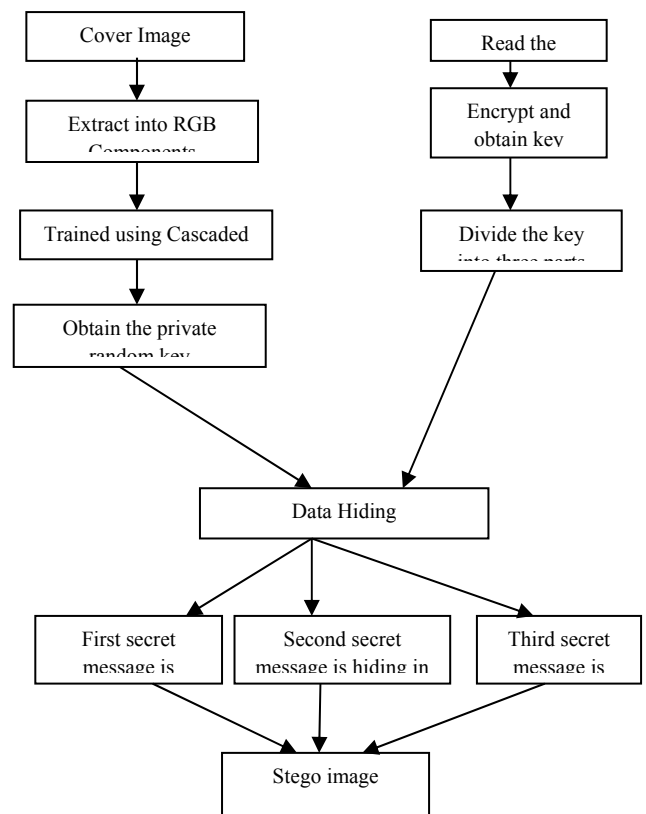


Figure 1: Data Embedding block diagram

This phase can be implemented by executing the following sequence of steps:

1. Get the color cover image
 2. Divide the color image into three color components and obtain the size of the each color components (x1: number of rows; y1 number of columns).
 3. Read the secret data in to text file and encrypt using AES Encryption algorithm and obtain the key.
 4. Obtain the size of the key and divide into three parts based on the key size (x2: size of the secret key)
 5. The three separated color components are given to cascade feed forward network and trained using LMA algorithm and the shuffle position are obtained.
 6. Generate 3 random private keys from the three color shuffled position.
- These keys can be implemented applying the following formulas:

```
Kxred=ceil (rand (1, rand (1, floor(x2/3)))*x1);  
Kyred=ceil (rand (1, rand (1, floor (x2/3)))*y1);  
Kxgreen= ceil (rand (1, rand (1, floor (x2/3)))*x1);  
Kygreen=ceil (rand (1, rand (1, floor (x2/3)))*y1);  
Kxblue=ceil (rand (1, rand (1, floor(x2/3)))*x1);  
Kyblue=ceil (rand (1, rand (1, floor (x2/3)))*y1);
```

7. First secret message is placed in Red component of the color image at the positions of the red color private key.
8. Second secret message is placed in green component of the color image at the positions of the green color private key.
9. Third secret message is placed in Blue component of the color image at the positions of the blue color private key.
10. The image after hiding the secret data and the embedding three color components into a single image and it is called as stego image

Phase 2: Extraction of secrete message

The obtained stego image as input for the receiver side. At the receiver side the reverse operation is performed to decrypt secret key and secret message.

V. EXPERIMENTAL RESULTS AND ANALYSIS

The proposed algorithm is used to hide secret data in the selected pixels, which meets all the requirements in perception and robustness and its produce very good results. he images are taken from the data set <http://sipi.usc.edu/database/>. We have used different color images of different sizes with various length size messages for justifying the process this is shown in Figures 2 to 5.



Covering image before embedding message



Red Color Component



Green Color Component

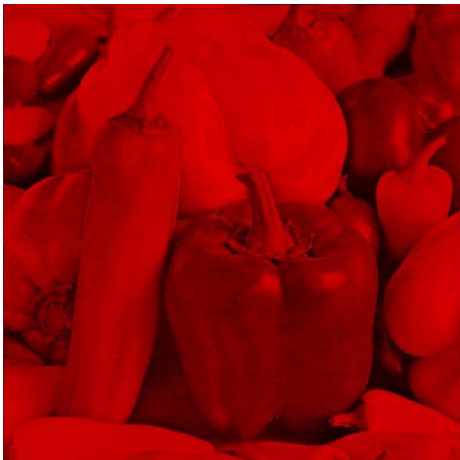
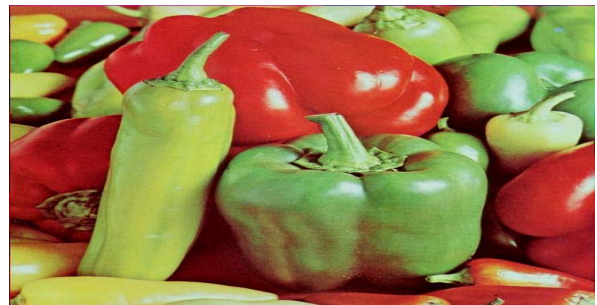


Blue Color Component



Holding Blue Component

Figure 2: Original image (with size 512*512*3)



Holding Red Component

Figure 3: Holding Image (message length=69)



Covering image before embedding
message



Holding Green Component



Red Color Component



Holding Green Component



Green Color Component



Holding Red Component



Blue Color Component

Figure 4: Original image (with size 512*512*3)



Holding Blue Component



Figure 5: Holding Image (message length=35)

5.1 Calculation of PSNR (Peak Signal to Noise Ratio) and MSE (Mean Square Error)

The Peak Signal to Noise Ratio and Mean Square Error are two important evaluation measurements for calculating image quality, for estimating noise ratio in the stego image and those two factors are used to differentiate original cover image with stego image.

The PSNR is used as a quality measurement between the original cover image or input image and a processed stego image. If the value of PSNR is high the quality of stego image is also good. The MSE is used to calculate the noise error ratio in between the original cover image and the processed stego image.

$$\text{PSNR} = 10 \log_{10}(\text{MAX}_i^2 / \text{MSE}) \quad (1)$$

$$\text{MSE} = \sum_{m,n} [I_1(m,n) - I_2(m,n)]^2 / M * N \quad (2)$$

5.2 Comparison Tables:

This section contains comparison for previous algorithms and proposed artificial neural network along with private key embedding algorithm. It clearly is seen that calculated values show some significant decrement which suggests that the proposed algorithm is slightly better than the previous approaches. MATLAB tools are used for evaluating results of the output image.

TABLE 1: PSNR Values and MSE Values Obtained

Cover Image(512*512)	PSNR	MSE
Peppers	69.85	0.0043
House	63.54	0.0017
Female	70.69	0.0046

TABLE 2: PSNR Comparison with other Algorithms

Author	Technique	PSNR
Siddharth et.al's	Discerte Wavelet transform (DWT)	41.54
Suneetha .D. et al's	LSB based Embedding	43.04
Proposed Algorithm	Artificial neural network along with private key embedding	70.69

VI. CONCLUSION

In this proposed approach a secure artificial neural network along with the private key embedding algorithm is used to embed secret message into a multiple components of a single cover image and obtains a high quality stego image with less noise ratio. The quality of stego image is obtained in terms of PSNR and MSE values. This approach can be used for improving embedding capacity level of high quality stego images.

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The Impacts of Demographic Variables of students on attitudes towards e-learning in higher education

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Abstract— The fast development of information, communication and technologies (ICT) has initiated an unparalleled transformation in universities all over the world. This development of technology and learning is offering new techniques to represent knowledge, new practices, and new global communities of students. E -learning is now increasing as the advance model for teaching and learning process in higher education. However, the integration of e-learning system in higher education is not an easy task because of some challenges. The aim of this paper is to analyses the impacts of demographic factors of students on their attitudes towards e-learning. Student attitudes and beliefs towards e-learning are regarded as success determinants of future e-learning initiatives. An analysis of relationships between student attitudes towards e-learning and their demographic characteristics: gender, study year, study program and e-learning knowledge is also included. The study was conducted for measuring the attitude of university students towards e -learning in University of Tetovo by taking 223 students from different study program and different study year. In this paper was used questionnaire to collect data from a sample of undergraduate students. Statistical techniques are used for the analyses of data. The result revealed that students' have high attitude towards e-learning and their attitude scores did not differ significantly according to gender, but on the other hand results indicate there was difference according to study year, study program and e-learning knowledge of students . The reported findings might be of interest to academics, administrators, and decision-makers involved in planning, developing and implementation of future e-learning strategies in Macedonia and similar developing countries. The obtained data, from such study, can provide information about what academic institutions can do before implementing e-learning to reduce and overcome the challenges in implementing e-learning in universities.

Keywords - student' attitudes, gender, study program, study year, e-learning knowledge.

I. INTRODUCTION

Information and Communication Technologies (ICT) have made a big change in the lifestyle of the people, their work and education in the 21st century. Over the past decade there has been a huge revolution in learning and educational computer applications and the use of computers in education, that increases day by day. With rapid development and

widespread use of e-mail, social networks, electronic books, chat rooms, web conferences, interactive multimedia applications and internet technologies, internet came into use as educational environment (Yamamoto, Demiray, & Kesim, 2011; Yapici & Akbayin, 2012). This new learning environment has been accompanied by such concepts as online learning, distance learning and e-learning. In the last years, the use of e-learning has been increasing rapidly and has become an important system offered by most colleges and universities all over the world. This comes as the consequence of the innovative transfer of knowledge and learning which has been influenced by the advent of the Internet and other ICT [1, 2]. This change has had a significant impact on the curricula, the methodology of teaching and learning processes. E-learning presents an opportunity to enhance learning as to create environments where students and teachers can share knowledge. Similarly, e-learning system enable students to access diverse contents any time and from any location. This gives students more control over their learning experience, enabling them to gather the materials they need and study when they have time to do so [3]. So, it is very important to design an efficient e-learning platform for teaching, learning, resources, and administration for higher education [4, 5, 6]

However, the major important question is here: Does the students are willing to adopt e-learning in their learning process and which demographic characteristics impacts in their attitudes toward e-learning? In order to find the answer was investigated the attitude of the students of University of Tetovo (UT) towards e-learning and impacts of the demographic characteristic of students on the attitudes toward e-learning. [7] Asserted that when people have favorable attitudes towards a particular technology, those people are more likely to use that technology. Research revealed that there are significant links between attitudes and beliefs and links between attitudes and behaviors, and that attitudes form the foundations of one's beliefs which influence one's behaviors [8].

Research has found that based on certain characteristics such as age, background, computing ability, computing attitude and motivation all have an impact on the likeness of students using a computer to support their studies [9]. Understanding student characteristics is especially crucial when need to implement e-learning system. The demographic

characteristics and technological skills are considered as global problem to the students. Therefore, understanding students' personal characteristics and e-learning system integration is necessary to introduce an effective e-learning. As for student's factors, the researchers focused on investigating students' characteristics regarding to their gender, and technology experience and skills also. Previous studies show that there is a rareness of researches about student's individual differences such as Gender, Technology Usage and Skills. A long list of research studies are available wherein demographic impacts have been measured on the attitudes of users towards e-learning in different countries [10, 11, 12, 13].

This research want to investigate the impact of the students demographic variables like age, gender, ICT experience, e-learning knowledge in their attitudes toward integration of e-learning on the teaching and learning process in University of Tetovo (UT). According to [14], e-learning and attitude were not examined in terms of different personal characteristics in any of these studies. In the present study, the attitude towards e-learning was examined by different personal characteristics of the students such as gender, department, class level, experience in using computer, frequency of using internet, learning method, way of studying and motivation type.

II. THEORETICAL BACKGROUND

In this part of the study, we will present some related previous studies on the variables under consideration for our paper proposal. Many researches investigate the influence of demographic profiles such as computer ownership, age, gender, education, personal skills and computer and internet on university students' attitude towards e-learning [15]. From the literature review shows that gender plays a important role in perception towards technology and attitudes on e-learning. Various studies have been undertaken to investigate the effect of gender, age, and year of study on student attitudes [15,16, 17, 18]. Also, [17] identified characteristics like age, gender, computer experience, technology acceptance, and individual learning styles as principal factors when investigating the students attitudes concerning e-learning processes. [19] examined the attitude towards e-learning of secondary students of Delhi and found that demographic variables play a significant role for e-learning.

Many studies confirmed that student's male have more positively attitudes towards e learning than female students [20]. According to [21], they concluded that female would accept information and communication technologies (ICTs) use more than males. [20] their findings confirmed that male owns a positive attitude toward e-Learning than female. [22] found no gender differences in relation to the attitudes towards e-learning. These results are in line with some recent research studies which revealed that the gap between men and women (gender divide) is narrowing [23, 24, 25, 26, 27].

[28] examined the familiarity of university students' in e-learning, discussion of analysis were carried out on the students' perceptions regarding to gender, technology usage

and the knowledge about e-learning implementation. Results shows that gender have a significant effect on attitudes towards e-learning [29], 46% of males from first-year students prefer replacing "traditional learning" by using computer in learning, while only 22% of women support this result.

The attitude toward e-learning can be viewed as an umbrella for the methods of education supported by ICT, and specified with the consent or lack of consent of the students or lack of consent on the importance of technology and their special skills. Besides that, students' attitude towards e-learning affected through what they see as the advantages and disadvantages for this type of education. [16] talking about e learning, a favorable attitude shows a greater probability that learners will accept the new learning system.

III. RESEARCH OBJECTIVE AND RESEARCH HYPOTHESIS

The objective of this study is to investigate and to assess if there are significant differences of demographic factors of UT students on attitudes towards integration of e-learning. So, the study was conducted with the following objectives:

- To conduct whether attitudes of UT students towards e-learning varies according to gender;
- To reveal whether attitudes of UT students towards e-learning varies according to study year;
- To reveal whether attitudes of UT students towards e-learning varies according to study program;
- To reveal whether attitudes of UT students towards e-learning varies according to e-learning knowledge;

From those objectives, were formulated some question as below:

1. What are the distributions of students of UT in terms of gender, study year, study field, e-learning knowledge?
2. What are the attitudes towards integration of e-learning among the students of UT?
3. Do the attitudes towards e-learning vary significantly among the students of UT by: (a) gender; (b) study year (c) study program; (d) e-learning knowledge.

The hypotheses for this study are as follows:

1. The first hypothesis (H1): There are no statistically significant differences in students' attitudes towards e-learning integration according to gender.
2. The second hypothesis (H2): There are statistically significant differences in students' attitudes towards e-learning integration according to study year.
3. The third hypothesis (H3): There are significant differences in attitudes towards e-learning integration according to study program.
4. The fourth hypothesis (H4): There are significant differences in attitudes towards e-learning integration according to e-learning knowledge.

IV. RESERCH METHODOLOGY

The purpose of this paper is to analyses effects and differences of students demographic factors on their attitude towards e-learning integration in higher education. Determining students' attitude towards e- learning represents an important stage in predicting the adoption of a certain behaviour. This research was conducted through a questionnaire developed through exploratory research. Survey was conducted to collect data and to prove the hypotheses.

The population for this study was students of University of Tetovo. A total of 200 questionnaires were distributed to students, comprising the following departments, such as Mathematics, Informatics and Economy and Business. Out of the 200 students who received the questionnaire, 185 completed and returned the questionnaire given an ninety two percent (92%) rate of return. The actual sample size used in the study was sufficient to meet this target sample size.

In this study, singular and relational survey methods were used. Singular survey method was used to determine the students' attitudes towards e-learning. Singular survey method focuses the research on a single variable and examines its change in a moment or in a period. The other was used to indicate the relationship between some variables and attitudes towards e-learning. Relational survey method is generally used to determine interactions between several variables. [30]. The data was analysed using SPSS software. Descriptive statistics were used to summarize and describe the data collected from the students.

The research instrument's reliability was assessed using Cronbach's alpha (α). In this paper, the significant differences between the students' attitudes toward integration of e-learning with the demographic variables were analyzed by using Analysis of variance (ANOVA) and T-test. The one-way ANOVA and T-test were employed to identify the effects of demographic variables on the students' attitudes towards e-learning. One-way ANOVA measures the mean of one or more groups based upon independent demographic variables. On the other hand, t-test is usually employed to evaluate the difference in the means between two groups.

The survey instrument consisted of two section. While the first section include 5 items of demographic characteristics of students, such are: gender, study year, department and e-learning knowledge. The second part, which is the Scale of students' Attitude towards integration of E- learning, consists of 11 items, each rates a 5-point Likert scale running from (1=Strongly disagree, 2=Disagree, 3=Undecided, 4= Agree, and 5= Strongly Agree).

Survey was distributed during the class under supervision of the lecturers. the objective of the survey was clear and understand for all participants. The survey was anonym that participants should not write their names or putting any personal information.

V. DATA ANALYSIS AND RESULTS

A. Descriptive statistics

Data was analyzed using Statistical Package for Social Science (SPSS) software. Descriptive statistics was done for each factor and also for the variable students' attitude toward integration of e-learning. Study collected data from 238 students. The frequency and percentage distributions were used to represents the demographic characteristics of the students (gender, study year, department, e-learning knowledge) which are presented in the **table 1**. The result for demographic profile by the respondent comprises that 114 (51.1 %) are female, whereas 109 (48.9%) were males. Students academic year of study was normally distributed with four years, first year, (53, 23.8%); second year (60, 26.9%); third year (60, 26.9%); and fourth year (50, 22.4 %). In terms of study program, results demonstrates that 72 (32.3%) students belongs to the Informatics, 69 (30.9%) Mathematics and, 82 (36.8%) Economy and Business. Finally, students who have knowledge about e-learning exceeded those who have used, with percentages of 150 (67.3%), compared to 73 (32.7%). In the table below was presented the descriptive statistics related to the scale of students' attitudes towards integration of e-learning.

The analyses of the students' attitude towards e-learning overall scores on the attitude scale indicated that students' responses to this scale were positive. Table 2 shows that all the participating students had positive attitudes towards integration technology and e-learning, they felt confident in using computers, enjoyed using ICTs in their studies, believed in the benefits of e-learning, and would be interested in studying courses that used e-learning. In particular, students believed strongly that e-learning would give them the opportunity to acquire new knowledge and enhance their learning experiences. Results show that the mean values scored was 42.15 that is more near the maximum, which represent positive students' attitude.

B. Reliability test for construct attitudes

Reliability was evaluated by considering the inter-item consistency assessed by Cronbach's Alpha value. The reliability analysis measured the internal validity and consistency of items used for each construct. In this study for the construct students' attitude towards e-learning was used to measure the reliability. Calculating Cronbach's alpha coefficient tested the factor reliability. This measures the internal consistency by indicating how a set of items are closely related as a group [31]. A Cronbach alpha value of 0.7 is acceptable, with a slightly lower value might sometimes be acceptable [32]. Cronbach's alpha values for factors is attitude above is 0.70 (see Table 3) indicating that all measures employed in this study demonstrate a satisfactory internal consistency. Therefore, the survey is considered a reliable measurement instrument.

TABLE 1. STUDENTS DEMOGRAPHIC CHARACTERISTICS

Characteristics	Category	Frequency & Percentage in the Study	
		N	%
Gender	Male	109	48.9%
	Female	114	51.1%
Study program	Informatics	72	32.3%
	Mathematics	69	30.9%
	Economy and Business	82	36.8%
Year of study	First (I)	53	23.8%
	Second (II)	60	26.9%
	Third (III)	60	29.9%
	Fourth (IV)	50	22.4%
E-learning knowledge	Yes	150	67.3%
	No	73	32.7%

TABLE 2. DESCRIPTIVE STATISTICS OF STUDENTS' ATTITUDES TOWARD E-LEARNING

Units	Value
Minimum	12.00
Maximum	59.00
Mean statistic and Standard error	42.1513 .45483
Standard deviation	7.01672
Variance	49.234
Coefficient Skewness (CS) and CS Standard error	.690 .158
Coefficient Kurtosis (CK) and CK Standard error	1.530 .314

TABLE 3: CRONBACH ALPHA COEFFICIENTS FOR CONSTRUCT ATTITUDE

Construct	Cronbach Alpha	Number of Items
Attitude toward e-learning	0.830	12

C. Hypothesis Testing

The significant differences between the students' attitudes toward integration of e-learning with the demographic variables were analyzed by using Analysis of variance (ANOVA) and T-test. The one-way ANOVA and T-test were employed to identify the effects of demographic variables on the students' attitudes towards e-learning. The Statistical Package for Social Sciences (SPSS) software tests the hypotheses.

1) Testing of First hypothesis (H1):

From the results in the table 4, shows the mean of attitude scores for male and female is found to be 42.49 (SD =5.79) for male and 43.12 (SD = 6.94) for female. This indicate that both male and female students of UT have high attitude towards e-learning although results indicate slightly differences between male and female students. The same results this finding corroborates the work of [33,34] who found that Indian postgraduate students have high positive attitude towards e-

learning. T-Value is found to be ($t = 45.044$) at significance level of (0.000) which is statistically significant. Female students have very slightly higher attitude towards e-learning than male, but we can conclude there are not differences between male and female students towards e-learning. This result supported by [35], who found that between male and female university no differences of attitude towards e-learning. In view of the above, the first hypothesis (H1) is accepted. Thus, There are no statistically significant differences in attitude towards e-learning integration, between UT students based on gender.

TABLE 4: RESULTS FROM TESTING HYPOTHESIS 1 (H1)

Variable	Gender	N	Mean	Std.	Df	(t) value	(Sig.) Level	Mean Differ.
difference in attitude towards e-learning based in students gender	F	114	43.12	6.94	222	45.044	.000	1.511
	M	108	42.49	5.79				

2) Testing of second (H2) hypothesis

In the table below, the mean of attitude scores for students of study program Informatics is found to be 44.14 (SD = 6.52), of the Mathematics 41.33 (SD = 5.95) and for students of Economy and Business 42.85 (SD=6.46) respectively. T-Value is found to be ($t = 36.717$) at significance level of (0.000) which is statistically significant. The results indicates that UT students from different study program have differences in a attitudes towards integration of e-learning. Thus, students of Informatics have higher Mean value than students of Economy and Business and also than Mathematics Students. Therefore, there are differences towards attitudes of e-learning between students of UT according to study program. So, the second hypothesis is accepted.

3) Testing of second (H3) hypothesis

The results provided in Table 6 show that there were significant differences in the levels of attitudes towards e-learning between students of different year of study students. Thus, results form table below shows that the mean of attitude scores for students of first year are 40.79 (SD = 6.09), for second year 42.48 (SD = 7.33), for third year 43.07 (SD=6.05) and for fourth year 45.04 (SD=5.25).

T-Value is found to be ($t = 34.110$) at significance level of (0.000) which is statistically significant. The results indicates that UT students from different year of study have differences in a attitudes towards integration of e-learning.

TABLE 5: RESULTS FROM TESTING HYPOTHESIS 2 (H2)

Variable	Study program	N	Mean	Std.	Df	(t) value	(Sig.) Level	Mean differ.
Difference in attitude towards e-learning based in students study program	Informatics	72	44.14	6.52	222	36.717	.000	2.045
	Mathematics	69	41.33	5.95				
	Economy and Business	82	42.85	6.46				

TABLE 6: RESULTS FROM TESTING HYPOTHESIS 3 (H3)

Variable	Year of study	N	Mean	Std.	Df	(t) value	(Sig.) Level	Mean differ.
Difference in attitude towards e-learning based in students year of study	first	53	40.79	6.09	222	34.110	.000	2.480
	second	60	42.48	7.33				
	third	60	43.07	6.05				
	fourth	50	45.04	5.25				

TABLE 7: RESULTS FROM TESTING HYPOTHESIS 4 (H4)

Variable	e-learning knowledge	N	Mean	Std.	Df	(t) value	(Sig.) Level	Mean differ.
Difference in attitude towards e-learning based in students study program	Yes	150	43.26	6.61	222	42.146	.000	1.33
	No	73	41.85	5.86				

Thus, students of fourth year have higher Mean value than students of, third, second and first. The results show that student level of attitudes towards e-learning according to year of study are listed descending from fourth year to first year. Therefore, there are differences towards attitudes of e-learning between students of UT according to year of study. So, the third hypothesis is accepted.

4) Testing of second (H4) hypothesis

Mean score of the students having knowledge about e-learning in relation to their attitudes towards e-learning is 43.26 (SD=6.61) while that of the students with no or very little knowledge about e-learning is 41.85 (SD=5.86). This finding imply that there are significant differences between students' attitudes towards e-learning and their knowledge about e-learning (Table 7). T-Value is found to be ($t = 42.146$) at significance level of (0.000) which is statistically significant. The results indicates that UT students according to knowledge about e-learning have differences in their attitudes towards integration of e-learning. Thus, students of with knowledge have Mean value than students with no knowledge about e-learning. So, the fourth hypothesis is accepted.

VI. DISCUSSION AND CONCLUSION

In this study has examined the impacts of gender, year of study, study program and e-learning knowledge on students' attitude towards the integration of e-learning. The results of the analysis made with the students of the University of Tetovo, students' attitudes towards e-learning correspond to Mean score of 42.1513, with minimum 12 and maximum 59. This shows that attitudes of the UT students towards e-

learning are positively at a good level. This result shows parallelism with some of the studies in the literature. In addition, this study has found that the influence of gender, year of study, study program and e-learning knowledge are statistically significant. therefore, outcomes from analyses provide strong support the four hypotheses. This study shows that e-learning is providing significant opportunities for higher education institutions (HEIs) and also provides an analysis of the influences of students' demographic factors on e-learning integration into higher education. The results obtained in this study indicate that there were no significant differences between the variable of gender and attitudes of the students toward integration of e-learning. This result shows similarity to the study in the literature [32]. In addition, results indicate difference towards attitudes of e-learning between students of UT according to year of study. Also, based on study program of the students of UT, there are differences between Informatics, Mathematics and Economy and Business students toward e-learning. Finally, finding imply that there are significant differences between students' attitudes towards e-learning and their knowledge about e-learning.

Since the E-Learning attitude has found to be very high for all groups, it is expected that the undergraduate student will accept to integrate the E-Learning strategy for learning during their university studies. In generally, attitude towards technology indicates in a certain degree the possibility of adopting certain behaviors. Talking about an e-learning system, a favorable and positive attitude of students towards it suggests a greater probability that they will accept it to integrate in the teaching and learning process in higher education.

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A NEW SELF-ADAPTIVE APPROACH FOR MEDICAL IMAGE SECURITY

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ABSTRACT:

Medical image is an important parameter for diagnosis to many diseases. Now day's telemedicine is major treatment based on medical images. The World Health Organization (WHO) established the Global Observatory for eHealth (GOe) to review the benefits that Information and communication technologies (ICTs) can bring to health care and patients' wellbeing. Securing medical images is important to protect the privacy of patients and assure data integrity. In this paper a new self-adaptive medical image encryption algorithm is proposed to improve its robustness. A corresponding size of matrix in the top right corner was created by the pixel gray-scale value of the top left corner under Chebyshev mapping. The gray-scale value of the top right corner block was then replaced by the matrix created before. The remaining blocks were encrypted in the same manner in clockwise until the top left corner block was finally encrypted. This algorithm is not restricted to the size of image and it is suitable to gray images and color images, which leads to better robustness. Meanwhile, the introduction of gray-scale value diffusion system equips this algorithm with powerful function of diffusion and disturbance.

Key words: Medical image, Telemedicine, Chaotic algorithm, Self-adaptive.

1.TRODUCTION:

Information and communication technologies (ICTs) have great potential to address some of the challenges faced by both developed and developing countries in providing accessible, cost effective, high-quality health care services. Telemedicine uses ICTs to overcome geographical barriers, and increase access to health care services. This is particularly beneficial for rural and underserved communities in developing countries – groups that traditionally suffer from lack of access to health care. In light of this potential, the World Health Organization (WHO) established the Global Observatory for eHealth (GOe) to review the benefits that ICTs can bring to health care and patients' wellbeing. The Observatory is charged with determining the status of eHealth solutions, including telemedicine, at the national, regional, and global level, and providing WHO's Member States with reliable information and guidance on best practices, policies, and standards in eHealth.

“The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities”.

The need to apply security techniques for medical images has increased with the use of telecommunications technologies for medical diagnosis and patient care when the provider and client are separated by distance. A system known as telemedicine is used in such cases. Telemedicine is important because it enables consultations by remote specialists, loss-free and immediately available individual patient information, and improved communication between partners in a health care system [1]. This leads to improvement in the quality of medical care, and simplifies access to medical databases, from which medical images can be either transmitted through a channel to a particular destination or stored and then given to the specialist. Transferring medical data such as radiological results from a medical data base center to another center or to a remote radiologist without applying security techniques means a low level of privacy for patients.

2. REVIEW OF LITERATURE:

Conventional encryption schemes like simple-DES, triple-DES, RSA, IDEA, AES are not appropriate to make cryptosystems for medical images, this is because of intrinsic features of medical image data; like bulk data capability and high redundancy. For encrypting the digital images data, plenty of encryption schemes have been proposed [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, and 16]. In the majority of the capable medical image encryption techniques, many researchers utilized chaos systems to accomplish the demand of reliable and secure protection / storage/ transmission of digital images through public networks. This is due to the verity that the chaotic signals have cryptographically enviable features such as high sensitivity to initial conditions/parameters, long periodicity, high randomness and mixing [8]. These features (or properties) make chaos-based image cryptosystems tremendous and robust against statistical attacks. The properties like high randomness, balanced-ness, confusion and diffusion needed in conventional cryptographic algorithms are achieved using states of chaotic maps obtained on iterative processing.

There are many different image chaotic encryption schemes, such as spatial domain encryption [17-22], frequency domain encryption [23], and adaptive encryption [25-27]. As the chaotic map has the sensitivity to the initial value and the parameter, the image encryption algorithm based on the chaotic map is more efficient and the high security. The high-dimensional chaotic map can be used to discretize the pixel values of the image, such as the use of only one-dimensional cat mapping, two cat mapping, Discrete index chaotic mapping and other technologies to achieve image encryption. In addition, based on the look-up table technology, switching technology [20] and a variety of mapping combinations [17] program is also presented. [23] based on the frequency domain to encrypt the image, the basic idea (Discrete Wavelet Transform (DWT)), and then scrambled the resulting low-frequency and vertical low-frequency (LL) matrix. Finally, the inverse discrete wavelet transform is used to obtain the encrypted image. But this does not change the statistical information of the image pixels.

3. PROPOSED WORK:

In the paper a new self-adaptive approach for medical image security. Compared with the traditional image-based encryption technology based on airspace or frequency domain, the algorithm scrambles and encrypts the other part of the data according to the part of the data of the medical image white body. After the image can effectively prevent the known plain attack. '10' pointed out that the algorithm's three defects: do not change the original medical image

pixel statistics; select the plain attack can reduce the complexity of the encryption algorithm; use 128 options. The key of the algorithm can be completely restored and the improved method is put forward: In the process of one round encryption, the S-box and the adaptive scrambling are used in the round key and / The improved algorithm can solve the above three defects

The '11' clever use of wave propagation to achieve medical image encryption. In the encrypted medical image, the medical image can be seen as a lake, through the analog wave on which to spread for encryption, and the wave can be superimposed, the effect of superposition is equal to the effect of the superposition of each wave. The wave propagation replaces the pixel values of the medical image pixels, and the adaptive structure will spread quickly to the entire ciphertext for any minor changes. Because of its use of modulo and XOR operation, the execution speed of the algorithm is improved. The document fills the input medical image so that it becomes a matrix of rows and columns that are multiples of four. But the literature did not explain how to restore the original medical image after decryption.

Based on the analysis of the characteristics of chaotic sequences, this paper proposes a new adaptive structure and gray value diffusion mechanism. The algorithm can achieve the performance requirements by two rounds of encryption.

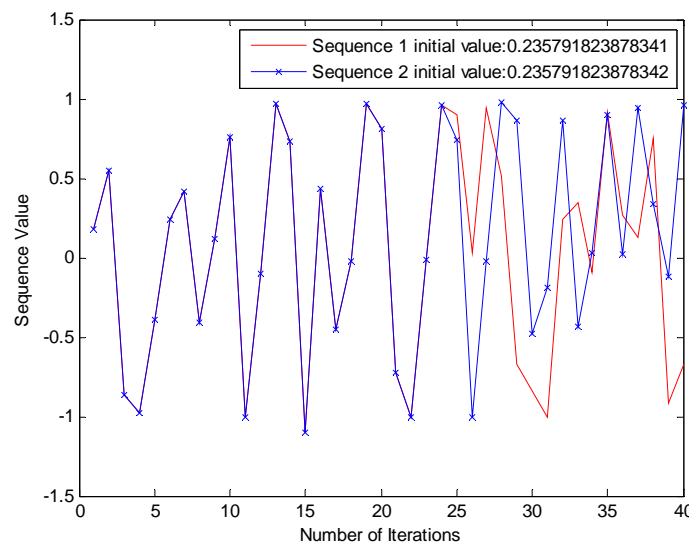


Figure 1. Chebyshev mapping of the two sequences of the initial difference of 10^{-15} chaotic orbit separation

4. CHEBYSHEV MAPPING AND GRAYSCALE DIFFUSION MECHANISM:

4.1. Chebyshev mapping

It is generally believed that chaos is a seemingly random, similar random phenomenon in the deterministic system, with the overall stability of local instability, sensitive dependence on the initial conditions, long-term

unpredictability and other characteristics [24]. Commonly used one-dimensional chaotic maps are Logistic, Kent., Chebyshev mapping. In this paper, Chebyshev mapping is used. The discrete form is defined as follows:

$$x(n+1) = \cos(k \arccos(x(n))); \quad -1 \leq x(n) \leq 1 \quad (1)$$

When k is the value of 4, the mapping produces the sequence x_0 . In the interval $[-1, 1]$ traversal, autocorrelation for the δ function, cross-correlation is 0. The small changes in the parameters or initial conditions of the chaotic system will affect the chaotic trajectory to a large extent. As shown in Fig. 1. the two chaotic sequences with initial values differ by 10^{-15} are rapidly separated after 24 iterations. The number of iterations n_0 . And the initial value x_0 . Can be used as the encryption algorithm key.

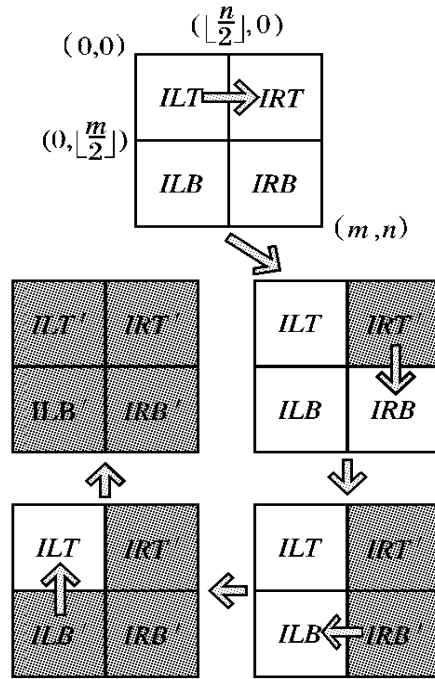


Figure. 2. 2x2 block structure of Adaptive medical image encryption

4.2. Gray-level Diffusion Mechanism

Gray-level Diffusion Function is defined:

$$I'_b(i, j) = ((I_b(i, j) + A(i, j)) \bmod N) \oplus I_0 \quad (2)$$

where i and j are the image block matrix I_b , respectively. Row and column of the index ; $I_b(i, j)$ for the replacement before the gray value; $I'_b(i, j)$ is the gray value after the replacement; I_0 is the gray value of the last replacement, the initial value takes the same value of all gray values of the previous block matrix; N is The gray scale is 256 for the 256 gray scale image. The mode is to keep the replaced gray value in the gray scale. In order to

make the tiny changes to the plaintext quickly spread to the entire cipher text, the initial value of the Chebyshev mapping x_0 . To transform:

$$x_0 = \frac{I_0}{256} \times x_0 \quad (3)$$

Preference of the equation (1). To make the chaotic orbit separate and continue iterations $i \times j$ times with the structure I_b . Such as the large matrix A, makes:

$$A(i, j) = \lfloor x_n \times N \rfloor \quad (4)$$

Where $\lfloor \bullet \rfloor$ round operator

The inverse transformation of (2) is:

$$I'_b(i, j) = \left((I'_b(i, j) \oplus I_0 + N - A(i, j)) \bmod N \right) \quad (5)$$

5. ADAPTIVE MEDICAL IMAGE ENCRYPTION ALGORITHM BASED ON CHAOTIC MAPPING:

This paper proposes a new structure of Adaptive medical image encryption, as shown in Figure 2. Adaptive medical image encryption and decryption required to divide the input image. Image classification method is commonly used to fill the medical image first and then divided into blocks of equal size, the decryption process also needs to be removed to fill part of the medical image in the end. This article without using the fill method, block size may be different. The first block encryption and decryption process does not depend on the 2nd block size depends only on the 2nd block of pixel-by-pixel values.

First, let the size of the input image I be $m \times n$, m and n . Pair I clockwise into 4 pieces, ILT -left corner, right corner of IRB , ILB_0 on the lower left.

5.1. Encryption Process

Combining the Chebyshev mapping and the gray scale diffusion function introduced in Chapter 1, the encryption process is:

- 1) The input image I is divided into four sub-blocks.
- 2) Encrypt each sub-block clockwise. If ILT is used to encrypt IRT , the IRT value of the gray value of each pixel of I_0 is calculated first:

$$I_0 = \bigoplus_{(i,j) \in I_b} ILT(i, j) \quad (6)$$

Obviously, I_0 the values do not depend on the size of the ILT , depending only on the pixel values of the ILT pixels.

- 3) According to equation (3) initial value x_0 for the Chebyshev map transformation and iterative n_0 . According to equation (4) constructing matrices A.

- 4) In the order of behaviour, the IRT is traversed in ascending order, and the gray value of each pixel is replaced by the equation (2), and the value of I_0 is updated once every other time, which is equal to the pixel value after replacement. After the traversal, get encrypted IRT'_0 .
- 5) Use the encrypted IRT 'application (2) and (4) to encrypt the IRB to get IRB' . Similarly, IRB' encrypts ILB to get ILB' , ILB' encrypts ILT to get ILT' , and combines ILT' , IRT' , IRB' , ILB' to get the encrypted image I' , and the end of the round of the encryption operation.

5.2. Decryption Process

- 1) Is consistent with the encryption process (1).
- 2) Decrypt each sub-block counter clockwise. ILB' is used to decrypt ILT' , and the exclusive-OR value of [LB gray value of each pixel] is calculated I_0 :

$$I_0 = \bigoplus_{(i,j) \in I_b} ILB'(i, j) \quad (7)$$

Likewise, the value of I_0 does not depend on the size of ILB' , depending only on the pixel values of each pixel ILB' .

- 3) Consistent with encryption process (3).
- 4) To the main sequence, ascending traverse ILB' , formula (5) to replace the pixel gray value, update the I_0 value after each traversal, which is equal to the replacement value. End of the traverse are decrypted ILT .
- 5) Use IRB' 'Apply(2) – (4) Ground, IRT' Decrypt IRB' 'Get IRB , ILT . Step Decrypt IRB' Get ILB . Similar to 'decrypted IRT' to get IRT , combined with ILT , IRT , IRB , ILB to get the decrypted image I , the end of a decryption operation.

5.3. Color image encryption and decryption

The color medical image consists of three color components, namely red (R), green (G) and blue (B). The encryption and decryption process of the gray medical image can be transplanted to the color medical image, the three components are independently encrypted / decrypted, and the final encryption / decryption result is combined into an encrypted / decrypted color medical image.

Table 1: Correlation Coefficient of adjacent pixels in plain text and cipher text MRI of brain image.

Direction	MRI of Brain		Qing Ming Shang hetu					
	Clear Text	Cipher text	Clear text			Cipher text		
			R	G	B	R	G	B
Horizontal	0.97	0.05	0.83	0.81	0.77	-0.04	0.05	-0.011
Vertical	0.96	0.04	0.89	0.83	0.80	-0.08	0.01	0.16
Diagonal	0.95	0.02	0.72	0.72	0.67	-0.04	-0.010	-0.015

Table 2: Correlation Coefficient of adjacent pixels in plain text and cipher text X-ray of the hands image.

Direction	X-ray of the hands		Qing Ming Shang hetu					
	Clear Text	Cipher text	Clear text			Cipher text		
			R	G	B	R	G	B
Horizontal	0.98	0.04	0.84	0.81	0.76	-0.03	0.05	-0.01
Vertical	0.97	0.03	0.88	0.85	0.82	-0.07	0.01	0.16
Diagonal	0.95	0.02	0.75	0.70	0.68	-0.04	-0.01	-0.014

6. EXPERIMENTAL RESULTS AND SAFETY ANALYSIS:

In the experiment, the plaintext is a 512 x 512 medical greyscale image and a 511x 229 fresco color picture; key. For 128, x_0 . For 0.3453.

6.1. Statistical analysis

6.1.1. Histogram

Fig.3. shows the comparison of histograms before and after (a) MRI of Brain and (b) X-ray of the Hands image encryption. Fig.4. shows the comparison of the histogram before and after the encryption of the river. It can be seen from the fig.3. that the encrypted histogram is relatively uniform, effectively masking the distribution of the pixels in the plaintext image, making the statistical analysis more difficult.

6.1.2. Pixel correlation

A good encryption algorithm key space should be large enough to resist brute force attack. This key,. Range of values 1024, iteration count n. Values for the positive integers. In MATLAB, simulation of precision of 101 '5, positive integers are represented by 16-bit binary, the key space is 2x10⁵ x2'6zz 1.3107 x10². Thus there is a large enough key space to resist brute force attack.

Table 3: Key change sensitivity test

Rounds	MRI of Brain	Plaintext and Cipher text	X-ray of the Hands	Plaintext and Cipher text
1	0.99621	0.99603	0.99632	0.99608
2	0.99632	0.99612	0.99624	0.99611
3	0.99595	0.99640	0.99595	0.99642
4	0.99587	0.99645	0.99582	0.99645
5	0.99615	0.99583	0.99621	0.99587

6.2. Key sensitivity analysis

Image encryption algorithm is an important measure of the avalanche effect. Strict avalanche effect that, when you change any 1 bit in the plaintext or keys, almost all of the encrypted data will be changed. The experiment, we will be, from 0.345 3 101 with '5, make it a 0.345300000000001, and compare the encrypted cipher text changes. Table 3 shows that the keys small change in the cipher text MRI of brain image data change rate average is above 99.5%. Fig.4. is a sensitivity test results round of encryption keys.

Table 4: Clear Change after INCPR & UACI

Rounds	MRI of Brain		Qing Ming Shang hetu		X-ray of the Hands		Qing Ming Shang hetu	
	NPCR	UACI	NPCR	UACI	NPCR	UACI	NPCR	UACI
1	0.49768	0.16673	0.49559	0.16639	0.49769	0.16681	0.49562	0.16642
2	0.99602	0.33513	0.99589	0.33553	0.99605	0.33511	0.99587	0.33553
3	0.99617	0.33435	0.99618	0.33417	0.99616	0.33434	0.99616	0.33415
4	0.99588	0.33415	0.99608	0.33465	0.99584	0.33412	0.99601	0.33463

6.3. Differential analysis

In order to test the effect of a pixel change on the entire ciphertext, two methods are usually used: the Number of Pixels Change Rate (NPCR) and the Unified Change Intensity (UACI). In the experiment, we changed the last 1 bit of the MRI of brain image and X-ray of the Hands from 1 to 0, and the last one of the R component of the Qingming River was changed from 1 to 0. Table 4 lists the rounds of NPCR and UACI values. As can be seen from Table 4, after two rounds of encryption, the energy relationship is relatively stable, suitable for embedded robust watermark, and P, B frame suitable for embedded in the motion vector fragile watermark, the next step in the I frame embedded

copyright And then the watermark information is embedded in the motion vector of P and B frames, so as to realize copyright authentication and content authentication.

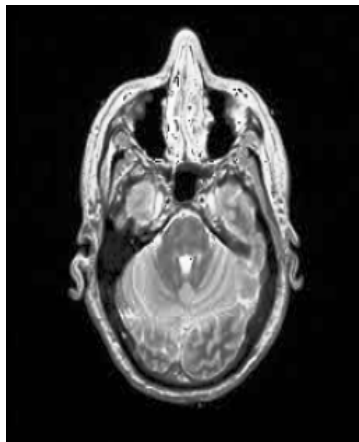
NPCR values were basically stable at around 0.996, UACI also fluctuated around 0.334. The first round of NPCR and UACI values is lower than the theoretical value because the changed 1-bit data is at the end of the plaintext, that is, the last encryption of the adaptive structure, so only affects the IRB and ILB two sub-blocks.

6.4. Performance analysis

In the gray scale diffusion, a simple addition, modulo and exclusive OR operation are used for each gray value of the images, and the time complexity is $O(n)$. In addition, each sub-block encryption only needs to construct an auxiliary matrix A equal to the size of the previous sub-block, and as long as two rounds of encryption can achieve the required performance.

7. CONCLUSION:

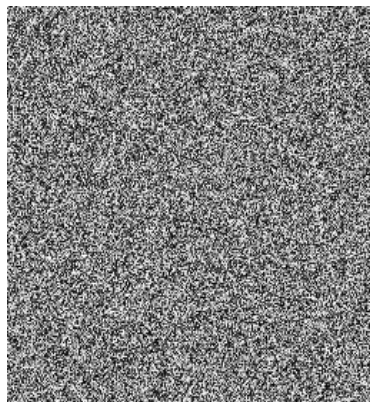
This paper presents a new adaptive structure and gray-scale diffusion mechanism for medical images security. The adaptive structure makes the tiny changes to the plaintext medical images quickly spread throughout the medical images ciphertext. The gray-scale diffusion mechanism makes the statistical information of the plaintext hidden, which can effectively resist the statistical analysis attack of medical images. The experimental results show that the algorithm has strong robustness and sensitivity to the key, and can effectively resist statistical analysis, exhaustive attack and differential attack for medical images.



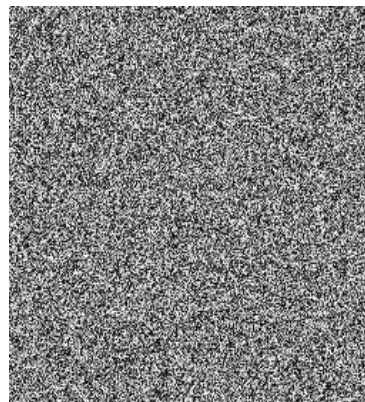
(a) MRI of Brain Plain text



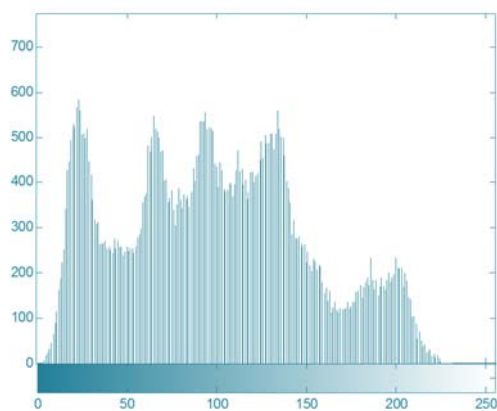
(b) X-ray of theHands Plain text



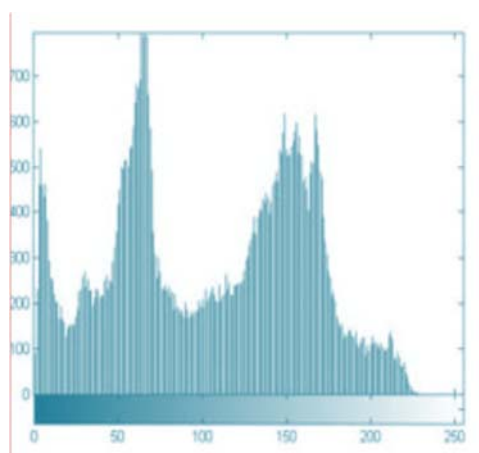
(c) MRI of Brain Cipher text



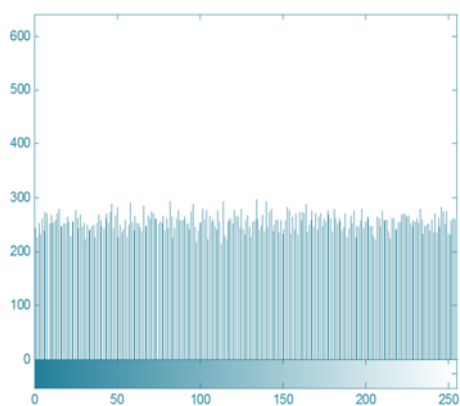
(d) X-ray of the Hands Cipher text



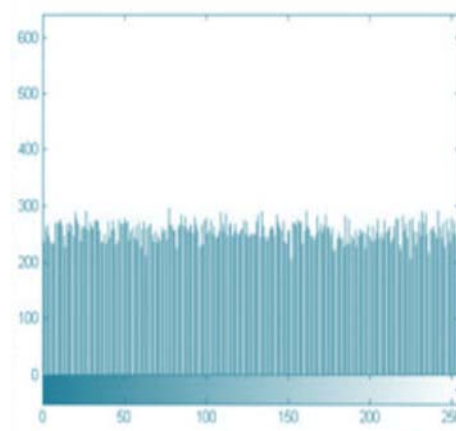
(e) MRI of Brain Plain Image Histogram



(f) X-ray of the Hands Plain Image Histogram

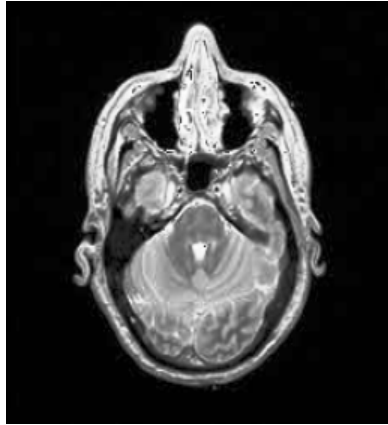


(g) MRI of Brain Cipher text Histogram

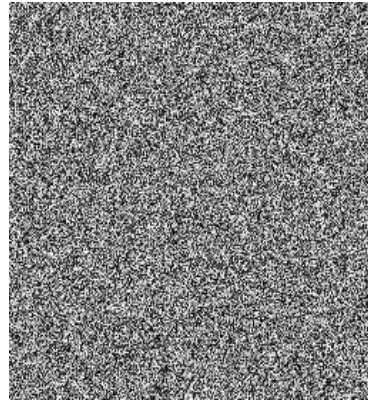
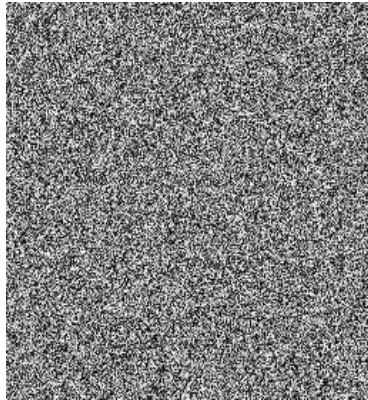


(h) X-ray of the Hands Cipher text Histogram

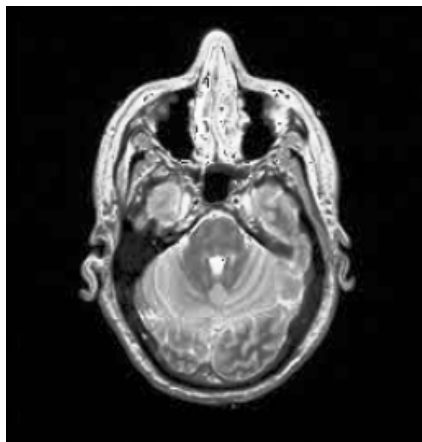
Figure.3. MRI of Brain and X-ray of the Hands plaintext and cipher text histograms.



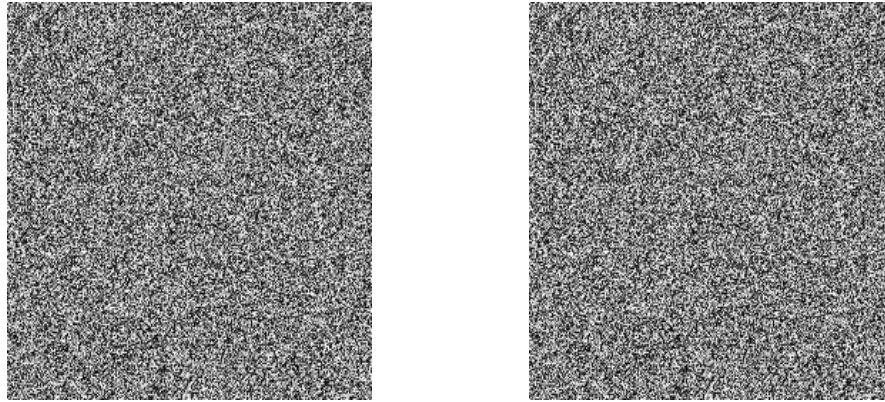
(i) MRI of Brain and X-ray of the Hands Plain text



(j) MRI of Brain and X-ray of the Hands Cipher text



(k) MRI of Brain and X-ray of the Hands Decryption with original key results



(l) MRI of Brain and X-ray of the Hands Keys change the 1-bit decryption results

Figure 4. Key sensitivity test results

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Business Process Simulation Essence and Component Based Conceptual Architecture

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Abstract— Optimal management is of the utmost importance not only for manufacturers but also for consumers. This involves maximizing profits, minimizing production and transport costs in the particular enterprise, and shortening delivery times for manufactured products to customers, while providing opportunities for flexibility in developing and changing new conditions. Simulation is the means for exploring different options for this at the lowest cost. The paper discusses the business process simulation essence. There are proposed the components of a business process simulator architecture.

I. INTRODUCTION

In today's economic reality the success of each economic unit depends to a large extent on its ability to react quickly and adequately to constant, dynamic changes in the environment. Under market conditions for organizations, it is vital to achieve a certain level of competitiveness. The up-to-date concept of simulation to optimize business processes in enterprises is driven by its importance for companies to survive in highly competitive economic conditions [3]. The reason encouraging businesses to approach their optimal management is to strive for orders to be executed reliably, faster than their competitors at low cost. In this regard, simulating business processes is an important prerequisite for achieving a number of key benefits, the main being exploring opportunities for lower costs and shorter production cycles through resource efficiency; better, more consistent and predictable results; opportunities for priority improvement of the organization's activity [6].

Simulation is an imitation of the action of a real process or system over a period of time. The simulation process requires a model to represent the key features of any physical or abstract system or process. The model presents the system itself, and the simulation visualizes the operation of the system over time.

Simulation is used on many occasions for various purposes, such as simulation of technology to optimize, to ensure safety in risk situations, to test different configurations for education and video games. Training simulators include pilot training simulators, whereby the latter gain real experience. Simulations are also used for scientific modeling of natural systems or human systems to see how they function inside. Simulation can be used to show the possible real effects of variable conditions and modes of action. Simulation is used when the true system is unavailable or can be dangerous or designed but not yet built or simply not.

The key results of the simulation include: obtaining reliable information about the selected important characteristics or process behaviour; use of simplified or cheaper approximations and tolerances within the simulation, with precisely defined parameters for the accuracy and validity of the simulation results [2].

II. CHANGES IN BUSINESS PROCESSES AND SIMULATION

Simulation is a tool for managing changes. Business Process Managers are aware of the utmost importance, attention and time they need to take on business processes upgrading. This refresh is too often imposed on companies and organizations whose goal is to stay up-to-date and keep their business profitable. Simulation is one of the ways to speed up and facilitate the process of business upgrading [4]. This possibility comes largely from the ability of the simulation to bring clarity to change. The simulation provides more than one answer in this connection: it shows the result that would be achieved in the presence of a particular change; it provides an opportunity to track all the benefits and the expected effect; it allows to generate a number of possible solutions.

Simulation is a component of the engine of business development and the improvement of its rules, regardless of the subject area in which it operates. Simulation can be applied to both theoretical and real-time workflow management systems. Engineers derive rules based on mental models created by business analysts by which they describe how processes and logic to follow in making decisions. The simulation helps to predict how a change can affect this logic. Formalization and simulation of created business models makes automating generating business rules more reliable. When designing new business rules, simulation provides an opportunity to ensure that processes run according to logic.

Modeling is a tool for describing business processes and an important precondition for ensuring readiness for the simulation process. The patterns define the boundaries of the system. There are a number of formalisms, software tools and methodologies that work to understand how to model, how to model, and how to analyze the patterns created [5]. Modeling is a necessary component for any simulation, but it is far from enough to carry out a simulation. To simulate the performance of a business process, a component is needed that can follow the logic of the particular business process during implementation.

Simulation is a fixation tool in time and space. This requires valid validation. Successful transformations of business processes are those that sustain the test of time and serve to solve real problems. They are characterized by months or years of operation and proven return on investment. Changes in these processes should not be risky, as consumers know what to expect from the process. But when changes are made within a proven business process, or an entirely new one is implemented, it cannot be guaranteed just that reliability for its performance. Simulation provides a mechanism for seamlessly bringing a business process into operation and significantly reduces the risks of doing so.

The validation of a business process can take place in many ways, but each structured method involves a series of qualitative and quantitative experiments. The logic of the business process determines the indicators to be tested as well as the values of the parameters which success or failure is expected. Demonstrative validation ends with a series of simulations. In many cases, pilot projects are conducted in a low-risk laboratory environment with a limited set of data to analyse the costs, benefits, risks and other results of their deployment.

The greater the number of possible alternatives in performing the business process, the simulation requires a careful selection of variables values and the application of various techniques in the design of simulation experiments. Regardless of the subject area, hard constraints for all business processes are time and space. Compression can be achieved both in just one way - by modelling and simulation.

The benefits of business process simulation described above provide a basis for seeking an architectural solution for a business process management system in which to summarize its capabilities, components, and core concepts of business processes. This is an important precondition for the adequate implementation of such a class of systems in organizations and for the full realization of its advantages.

III. COMMON ARCHITECTURE OF THE BUSINESS PROCESSES SIMULATOR

The related work review is hard to implement due to the fact that a detailed description of a particular architecture is absent in the documentation of most business process management tools.

The common description of the architecture of business process management systems is that it covers the structure of the system and the specific solution for its construction. Business processes are a basic unit in the activities of any subject area. From the automation point of view, processes can be considered as a set of sequential activities that result in the achievement of a certain user goal [9]. The implementation of business processes involves both people (from or outside the organization) as well as software systems. In this plan, the activities that make up the business processes can be divided into:

- Activities that are performed by people only;
- System activities that are fully automated and interactive activities where people interact with the system.

Most activities are interactive or systemic. For a few processes, human intervention is required to confirm the occurrence of an event and allow the process to continue to run. Managing the sequence of business process implementation is based on an established logic scheme that coordinates and synchronizes through "orchestration" and various "choreographies". Orchestration provides for the implementation of the process activities in accordance with the restrictions imposed and the interaction between a set of business processes is described by their "choreography" in which case there is no centralized component for managing and coordinating the activities performed, and the interaction is done by sending and receiving of messages according to common rules [10]. In order to synthesize the architectural components of a business process simulation module, it is necessary to clarify the logical sequence of the actions that make up the simulation process. There is a direct link to the lifecycle of the business process in the organization. Fig. 1 presents the simulation stages of a business process as the logical sequence of steps.

The first step that kicks off the simulation of any business process is defining it as part of the overall business logic of the organization. Here is a description of his model and storing this description. It is important to define business logic and rules that are an integral part of the described model. Because simulation is primarily done to search for and choose better business solutions, defining multiple key values and parameters is a responsible part of the simulation process. The following is a simulation, which is the implementation of the described models with differently defined values of their parameters. All results of the simulations performed are documented.

An analysis of the recorded data and measurement of the level of satisfaction according to the set requirements is followed. At this stage, there are two options for continuation according to the established results. The first is to be unsatisfactory and to redefine the parameters.

The second option is to establish an opportunity for the process to be improved and it is natural for the simulated process to be validated as a permanent one in the automated business processes of the organization.

From the point of view of managing and automating a business process, it can be designed, simulated, used and / or evaluated. In view of the specified design requirements, the business process model is developed or changed. Consequently, simulation, execution and / or evaluation is performed.

The business process model contains a logical formality of its activities and the limitations of their implementation. It presents the participants - people and / or systems and the resources used in the implementation [7].

In most cases, the created models are verified and their implementation is simulated. Target simulation results may vary: examine different behavioral parameters in multivariate conditions - for example, number of parallel queries; to measure and analyze the execution time, to determine an

optimal amount of resources, to define procedures for handling exceptions, to determine the cost of the process [8].

business process there must be a logical model that is independent of the environment for the implementation of the process; certain business rules based on which it can be implemented in a specific environment and infrastructure.

IV. ARCHITECTURE'S COMPONENTS OF A SIMULATOR OF BUSINESS PROCESSES

Every software architecture is a structured framework used to conceptualize software elements, relationships, and properties. It is also being developed to serve as a document facilitating communication between stakeholders, containing descriptions of both early solutions and high-level decisions on the design of a system and its components. The task of software architecture is by abstraction to define in general the basic modules of the designed system in order to reduce the complexity.

As mentioned, every common software architecture has an abstract character and presents the main features of the system. Here, the aim is to establish the subsystems and their components, the links between them, without reflecting the specifics necessary for their realization. Figure 2 shows a common architecture of a business process simulator from a selected subject area, which consists of several components: Business Process Conversion, Simulation Results Analyzer, Business Process Model Store, Business Logic Definition Store, and rules, storage with records of performed simulations, library with generated meta models, library with a description of the subject area (most often ontology). The description of application specificity and constructed models of existing processes are in two libraries with a description of data. They contain the data involved in the operation of a system. This includes one or more distributed database management systems, as well as document repositories of different types.

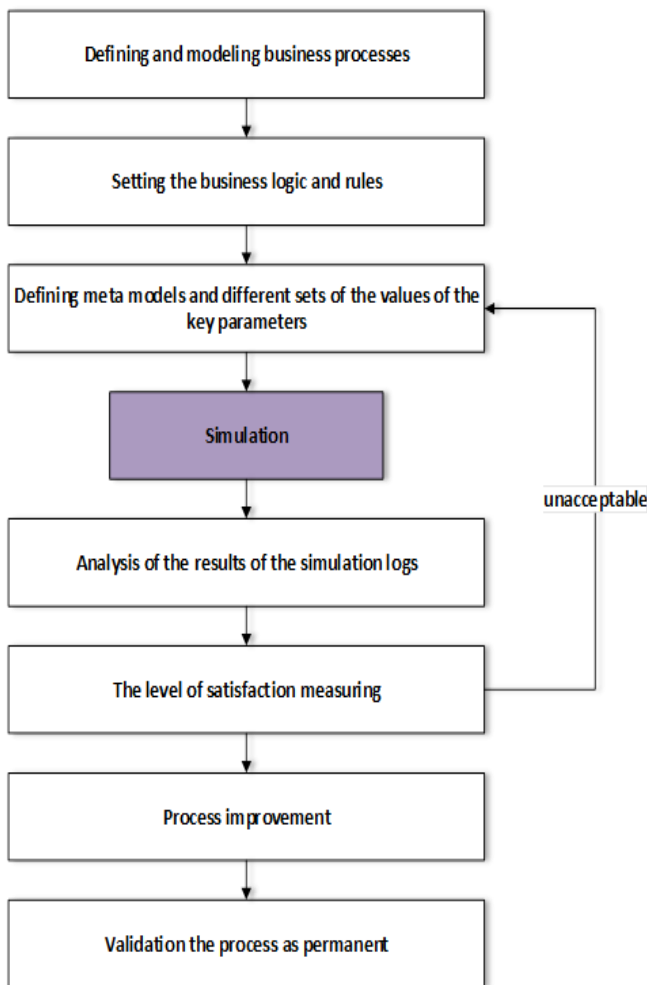


Fig. 1. Stages in Business Process Simulation

In the simulation process, the defined model of a process is transformed into an executable sequence of instructions. It must be precise and unambiguous, i.e. in formal form to unambiguously present his logic. During simulation, it is good to be able to create multiple copies of the same business process to track certain conditions with certain participants. In doing so, certain features, coordination and synchronization of the activities of the processes and the people involved in the implementation should be monitored. It is a good idea to have a flexible intervention in the event of critical situations, as well as the results of the implementation of the individual steps of the process, its management events, errors and exceptions to be recorded in protocols for future analysis.

Business process evaluation analyzes the data from the protocols recorded in the simulation process, identifies problems and makes improvements. For this purpose, it is advisable to provide a variety of reports on the implementation of the processes.

From the written above and from the sequence presented in Figure 1, it can be summarized that in order to simulate a

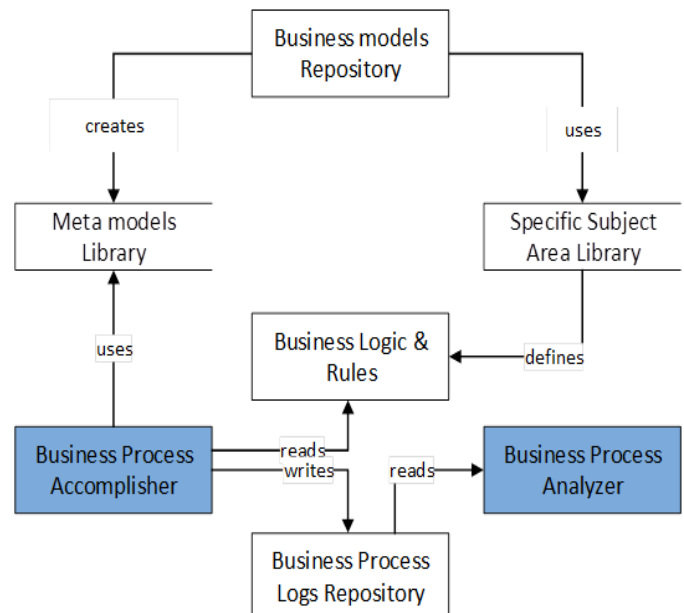


Fig. 2. Common architecture of a business process simulator

A business process simulator must have a logical model log entry that can read and follow the relevant business rules to replicate business process behavior by enabling orchestrating, managing process execution, creating performance protocols and means for developing different reports.

Business Process Conversion is the main simulation component of architecture and offers features designed to implement these models and automated process estimation. Its functions are of a dynamic nature and are performed many times. The description of the processes and their business rules must be presented with precision and without logical contradictions. The most existing systems use languages, such as XML Process Definition Language (XPDL), Example Application Markup Language (XAML), Business Process Execution Language (BPEL), WS-BPEL (Web Services Business Execution Language), XLANG (WSDL Extension - Web Service Definition Language) [1, 11].

The business process repository stands in direct communication with a business logic implementation subsystem and the rules described in the business process model. By reading these definitions, the business builder builds an executable model by managing its conversion into a sequence of instructions. You can use specific solutions such as BizTalk Server, Tibco EAI, MQSeries, and others to communicate between storage, business logic controller, and policy and developer.

Another essential function of the developer is the performance of the process and the possibility of evaluation from the performance. The business process generator includes a full set of tools for modeling, including a module with the ability to transform the process model into a logical sequence of instructions. The main component of the Process Conductor is the means of their implementation. Here, according to all the rules and reported specificities, specimens of the process, are created and executed.

In order to ensure the proper implementation of the processes, architecture is a distinct place to manage business logic and rules. Business rules used to manage processes change very often, and this separation will result in greater flexibility in the solution.

For similar reasons, it is good to set up a tool for event management, which interacts with external components as well as between business processes. Errors and exceptions can also be handled as events that stop the process or start a process to process. The main communication between the processes is based on messaging. They serve as process orchestration and synchronization, are used in event processing, and provide the flexibility and variety of

composite solutions that are implemented by the implementation module.

V. CONCLUSIONS

In the summary, it is possible to say that an attempt has been made to clarify the essence of business process simulation in its multi-aspect, including reflexivity in terms of changes in business, as also the types of simulation models are commented on because of their multiplicity. Deploying these concepts in depth is essential to synthesize the software architecture components of a business process simulator from a given subject area. The approach applied aims to reflect both points of view - managers and consumers who are particularly important to help and facilitate the management and implementation of business processes in the organization.

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The Role of Shologuti in Artificial Intelligence Research: A Rural Game of Bangladesh

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Abstract— Shologuti has three major component: move generation, search and evaluation. Each component are pretty much necessary, though evaluation with its quiescence analysis is the main part which makes each program's play unique. To make this game more striking, most reliable algorithms and its many supporting aids are used here. Main components of the game tree search and pruning are analyzed here and the performance refinements such as aspiration variation search, assists like transposition and history table are compared here.

Keywords— Artificial Intelligence. Design, Game, Extinct, Shologuti.

I. INTRODUCTION

Shologuti is very famous and popular game in Bangladesh and some of the Indian regions. It actually a checker type game which basically played between two players. So from that view, it can be called as a rural version or innovation of chess. The local people play this game for passing their leisure period even sometimes they arrange tournament of this game. Generally the board of this game is very simple like the people can draw it in table or ground and use stones, dry branch or a small piece of cane as pawns. After drawing, two players take their place at the opposite direction of the board with their 32 guti's altogether of which everyone try to achieve opponent's sixteen beads. After placing 16 pawn from the edge of the board, the game starts by making a move on the empty space. The pawn can move right, left, forward, backward and crosswise where each opponent actually try to take or occupy others pawns. If any player's pawn can cross opponent's pawn, then the pawn will be out of the board. After that, only that pawn can have a bonus move if that pawn can find out opponents pawn can be crossed over. By this process, which player can take or capture all the pawns of opponents, he or she will be the winner.

Now a days, computer has become a part of our life and almost everyone likes to play game in it. This led us to develop this attractive game of Shologuti. Due to lack of well-designed boards in market, city's people can't play it or don't even actually well known about the game. So, the problem can be solved by developing this game with an attractive UI. After designing the basic part of this research [16], we are intended to push artificial intelligence part in this program to make it more fascinating.

II. LITERATURE REVIEW

In general, this research covers the literature review from different sources which is targeted various aspect of designing game, installation & learning.

Whitby et al. [1] concerned in his research about the creation of a game installation and a reviewed a case study to test the game. Coleman et al. [2] described the initiatives they took to develop & design a game for improving their skills. Symborski et al. [3] & Martey et al. [5] also showed the game development and design strategy guided by experimental test and evaluation. Sethi et al. [4] described "Don't just play a game, design a game & build a game and improve your programming skills". Amory et al. [9], Cheng et.al [10] & Dondlinger [12] developed a game which is actually a part of social & mental development. Schrier et al. [11] designed a game which was filled with moral scenarios & moral choices. Nergiz et al. [13] & Strzalkowski et.al [14] described the experiences from the implementation of a computer game development that it could help a student to improve in problem solving, the application of previously learned knowledge, the utilization of independent learning and learning by doing.

Then Reidl et al. [15], Thune et al. [16], Nasr et al. [17] and Harrison et al. [18] described in their research that Artificial intelligence has long been an important part of game design and development practices. Treanor et al. [19], Eladhari et al. [20] and Magerko et al. [21] identified design patterns for AI in games like AI-based games put AI in the foreground of the player experience in their research.

After that, we (Nawshin et al. [22]) developed and reviewed the development part of Shologuti in our research document where we wanted to describe and analyze a computer based game (Player vs Player) which will help our culture to save an extinct rural game.

So, in extension, we are intended to use more interesting algorithms to develop the AI vs player environment which will increase the performance to make this game more accurate, unique and enjoyable.

In the coming chapters, we will discuss system architecture of the developed game in Chapter III, Chapter IV deals with the physical implementation and results, and finally, Chapter V shows us the conclusion.

III. SYSTEM ARCHITECTURE

To explain the entire system as well as the game, an effective architectural system needs to be designed. This section will represent the basic design part. The control flow of the program among various functions is shown using a single flowchart. Each function in the program is well defined and their pseudo codes are given for better understanding of the program. This section contains Control flow diagram, Function description and Pseudo code which will represent a clear understanding about move generation, search and evaluation part of this game.

A. Control flow diagram

PvAI Algorithm Workflow in fig 1 shows the entire execution sequence of functions in the program. In this program, two players can play continuously that is PvP (Player vs. Player) which is already developed [16]. In this game, a single player can also play by a good contribution of AI.

B. Function description

1) Handover

Handover is the starting function for AI part of the game. When the player complete his turn handover function is called. First of all this function clears the array named points to make it ready to use again. Then it calls AI_Moves, Sorting, sets up AICsp (the starting position of AI's best move) and AICep (the ending position of AI's best move) based on the sorting and finally AI_Pawn_Loc.

Pseudo code:

Step 1: Clear array "Points"

Step 2: Call AI_Moves ()

Step 3: Call Sorting()

Step 4: Set

AICsp = points[0,0,0]

AICep = points[0,1,0]

Step 5: Call AI_Pawn_Loc(AICsp, AICep)

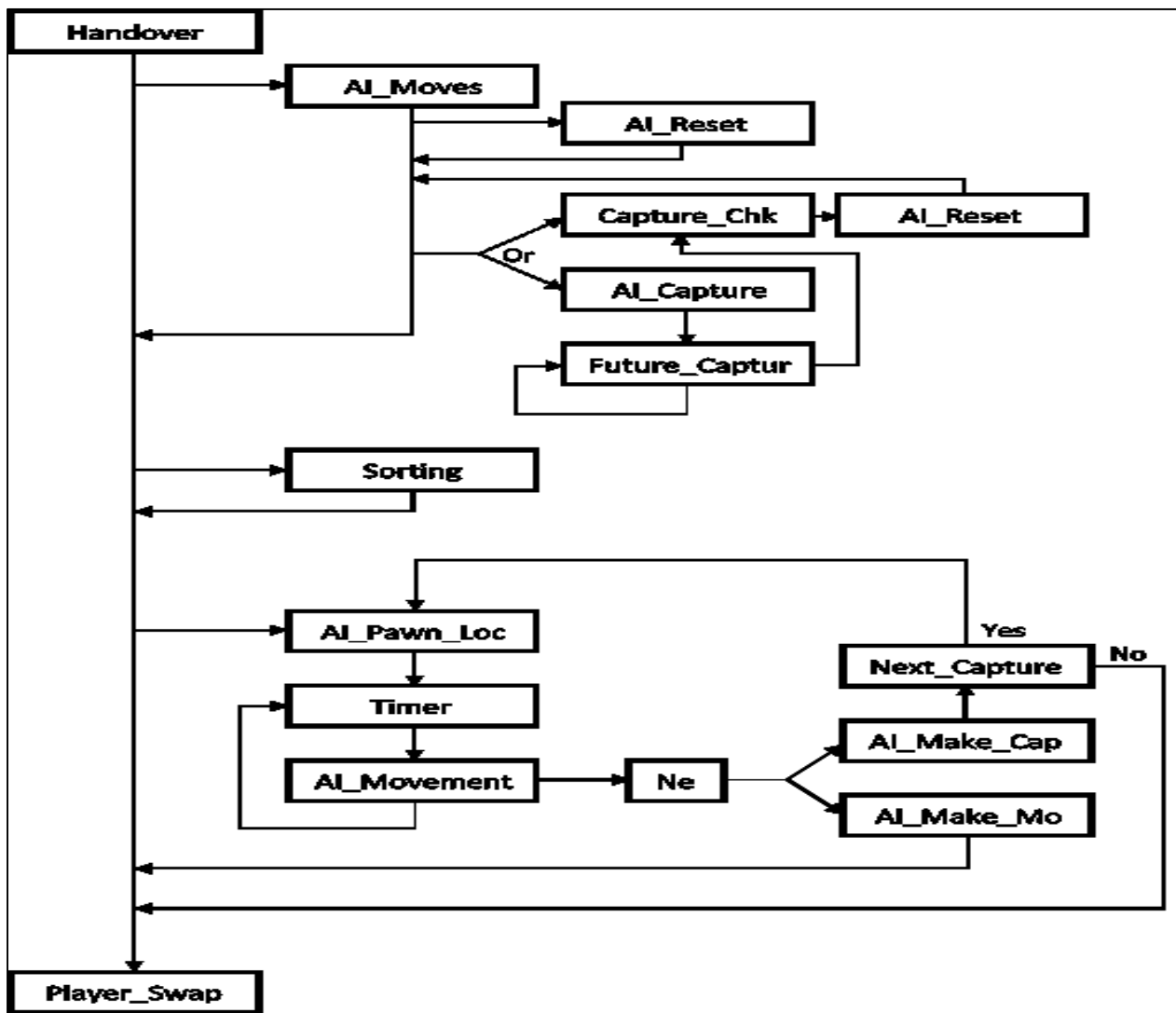


Fig.1. PvAI Algorithm Workflow

2) AI_Moves

AI_Moves function along with some other functions acts as the mini-max mechanism of the game. This function particularly focuses on each available AI's pawns adjacent positions. First it checks for all the available pawns on the board and store them in the array. Then takes a pawn each time, and searches its adjacent positions. Checks each adjacent positions value. If the value is 0 (represents open position). It stores that position as possible end point on array and calls Capture_Check with parameter as that position. if the adjacent position is 1 (represents enemy pawn), it calls AI_Capture function with parameter of starting position and that position. The function ends when each adjacent position for each pawn is calculated and points are distributed.

Pseudo code:

Step 1: Call AI_Reset()

Step 2: Set $x=0$

Step 3: For every position on the board

Set $z=0$

Set $\text{points}[x,0,z]=\text{current position}$

Step 4: For every current position

Check every adjacent positions value

Step 5: If value of current adjacent position is = 0

Set $\text{points}[x,1,z] = \text{current adjacent position}$

Call Capture_Check($\text{points}[x,0,z]$, $\text{points}[x,1,z]$)

$z=z+1$, AI_Reset()

Step 6: If value of current adjacent position is 1

Call AI_Capture with parameter $\text{points}[x,0,z]$ and $\text{points}[x,1,z]$

$z=z+1$, AI_Reset()

Step 7: $x=x+1$

3) AI_Reset

AI_Reset function is very important function for the AI part of the game. To calculate and distribute points to each possible moves to evaluate the best move, we have to manipulate the variables that represent pawn on the board. But original variables can't be manipulated directly or the game would become a chaos. So a dummy board or replica is needed. This function replicates the board and lets the needed change happen for calculation. This provides with the ability to calculate using the same info as the board but not change it in the process.

Pseudo code:

- Copy every positions value to similar AI variables
| $ai0 = a0$, $ai2 = a2$ etc.

4) Capture_Check

This function is the first function that sets points as the mini-max mechanism. This function checks if an AI pawn is moved to a new position, is there any chance that it would be captured by an enemy pawn or not. If there is a chance the pawn may be captured, this will subtract 4 points from the array for that move. If not, it will add three points to it.

Pseudo code:

Step 1: Check for each possible enemy capture for this move.

Step 2: If there is a possible enemy capture

Set $\text{points}[x,2,z] = \text{points}[x,2,z] - 4$;

Step 3: Else Set $\text{points}[x,2,z] = \text{points}[x,2,z] + 3$;

Call Future_Capture with parameter $[x,1,z]$

5) AI_Capture

This is another function of the mini-max mechanism. This function takes the starting and the adjacent enemy position and checks for the third position's value to be 0 (represents open location). If the 3rd position is open, it adds 10 points in the array and calls Future_capture function with the 3rd position as parameter.

Pseudo code:

Step 1: Get starting and capture position from AI_Moves

Step 2: If the third position on the line is open

Set $\text{points}[x,2,z] = \text{points}[x,2,z] + 10$;

Set $\text{points}[x,1,z] = \text{Third Position}$

Call Future_Capture with parameter $\text{points}[x,1,z]$

6) Future_Capture

This function is used to detect any possible bonus capture moves. As per Sholo-Guti rules, a player can make several capture moves at a time with a single pawn if possible. If possible it adds 5 points to the array for that move, and recurses using the future endpoint for this bonus move. The recursion continues till there are no more bonus moves possible and then calls the Capture_Check function with the parameter of captured location (FSP) and ending position (FEP) it gets at the final recursion.

Pseudo code:

Step 1: Set FSP = null & FEP = null

Step 2: Check if any capture move is possible

Step 3: If possible,

Set FSP = Capturable enemy pawn position

Set FEP = Next open position on the line

Call Future_Capture with parameter FEP

Step 4: If not,

Call Capture_Check with parameter FSP and FEP

7) Sorting

After the mini-max part is done, the array is full with each possible move and their respective points. The array then is sorted. Firstly the best move for each pawn is sorted out and brought to the top, i.e. $z=0$ of the array. And then the best move between all the pawns is sorted and brought to the beginning column i.e. $x=0$ of the array. After this process the first column of first page of the array holds the best moves starting position, ending position and its points. The array is string type array so to manipulate numeric value. After this the control returns to handover function.

Pseudo code:

- Sorts the array using Bubble sort technique and ascends the best move based on the points assigned during previous function operation.

8) AI_Pawn_Loc

AICsp is usually set as the first starting point and AICep is set as first ending point on the array by the function Handover. In case of multiple captures, this function is called again using modified AICsp and AICep. This function then finds out the X & Y coordination for both the AICsp and AICep positions and put them in SPx, SPy, EPx and EPy accordingly. Then it starts the timer function.

Pseudo code:

Step 1: Get AICsp, AICep

Step 2: Set

SPx = X Co-ordination of AICsp

SPy = Y Co-ordination of AICsp

EPx = X Co-ordination of AICep

Epy = Y Co-ordination of AICep

Step 3: Start timer function

9) Timer

Timer function is used to recourse a function after a fixed time. Each time timer is activated it calls AI-Movement function till SPx = EPx and SPy = EPy. When the condition is met, timer stops and calls function Next.

Pseudo code:

Step 1: Call AI_Movement()

After certain time till SPx = EPx and SPy = EPy

Step 2: Stop timer, call Next()

10) AI_Movement

AI_Movement function is responsible for the movement of AI pawn. It detects which pawn to move from and to where and which direction. It increases or decreases SPx & SPy by 4 each and moves the pawn to new SPx & SPy, time till it matches EPx & EPy. This creates the movement of AI's pawn.

Pseudo code:

Step 1: If SPx < EPx

SPx = SPx + 4

Else

SPx = SPx - 4

Step 2: If SPy < EPy

SPy = SPy + 4

Else

SPy = SPy - 4

11) Next

After the mini-max mechanism and sorting happened, AI has the best move to make. Timer function moves the pawn to the desired position but the value of the board has to change. AI_Make_Move, AI_Make_Capture functions make that happen. After these functions are called and executed, the control again returns to next function and player swap function is called to swap the program control to the pvp part of the game for player to make his move. And the game progresses.

Pseudo code:

Step 1: Call AI_Make_Move(AICsp,AICep)

Step 2: Call AI_Make_Capture(AICsp,AICep)

Step 3: Call Player_Swap()

12) AI_Make_Move

AI_Make_Move function is used to change the value in board when AI makes a normal move

Pseudo code:

Step 1: Move pawn from AICsp position to AICep position

Step 2: Set AICep positions value as AICsp positions value

Step 3: Set AICsp positions value as default 0.

13) AI_Make_Capture

AI make capture function is used when AI makes a capture move. It sets AICep positions value as AICsp positions value. And AICsp positions value is set as default 0. The position in between value is set as default 0. Captured pawn count is increased by 1 and enemy pawn count is decreased by 1. Then the function calls Next_Capture function using parameter AICep.

Pseudo code:

Step 1: Move pawn from AICsp to AICep

Step 2: Hide pawn between AICsp and AICep

Count enemy pawn = pawn - 1

Step 3: Call Next_Capture using parameter AICep

14) Next_Capture

Next_Capture function checks each adjacent position of AICep position for enemy pawn, if found, it checks if capture move is possible. If possible it sets AICsp as AICep, AICep as new ending position, and calls function AI_Pawn_Loc using these parameter. This process keeps repeating till there is no more capture move possible. And returns control to function next.

Pseudo code:

➤ If any more capture possible

Set

AICsp = AICep

AICep = Ending Position

Call AI_Pawn_Loc() using parameter AICsp and AICep.

IV. IMPLEMENTATION AND RESULTS

A. Selecting the Game Type

When the game starts if it detects a previously saved game, the game is loaded with previously saved properties. If not, a window shows up like this and asks the player to select a game type, either a PvP or PvAI. Fig.2. is the screenshot of Selecting the Game Type.



Fig.2. Selecting the Game Type

B. Player vs. Computer

If the player selects to play a new game of PvAI, the board is loaded with pawns set in their default starting position and then the player gets to play the first move always. When a move is made by the player, AI will take a move automatically. Fig.3. is the screenshot of Player vs. Computer.

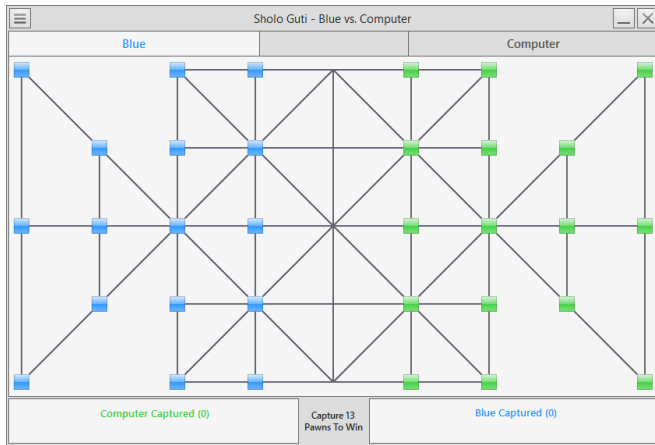


Fig.3. Default Board - Player vs. Computer

C. Pawn Movements

1) Player Pawn

If the player selects a pawn of his own, then possible moves are shown in the board in Yellow and Red. Yellow color represents normal movable positions and Red color represents capturable positions on the board. Fig.4. is the screenshot of Pawn Movements of Player Pawn.

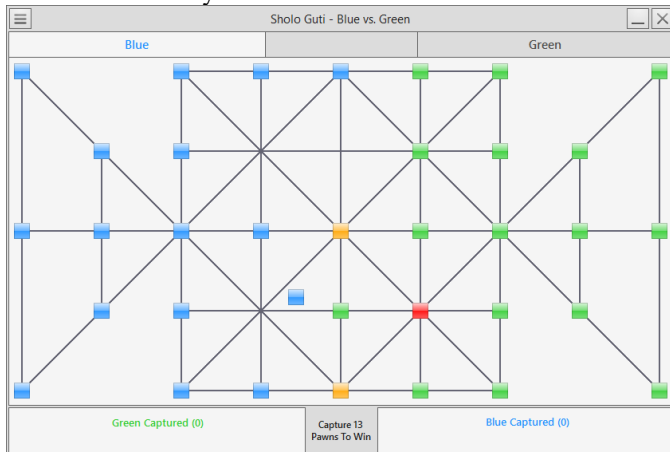


Fig.4. Pawn Movements - Player Pawn

2) AI Pawn

When a move is made by the user AI will make a move to best possible location among all of its own pawn and after making a move AI will hand over the game to the player.

If there is any capture move possible AI will take that move. And then if another capture is possible with that pawn again, AI will take that move too and will be looking to capture more pawns with that pawn if possible. Else, AI will hand over the game to the player. Fig.5. is the screenshot of Pawn Movements taken by AI Pawn.

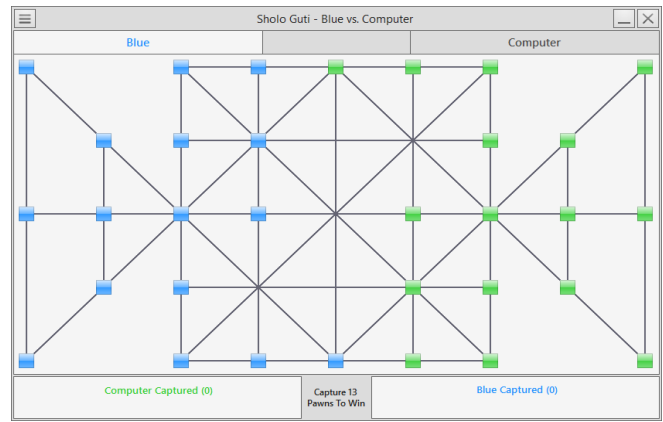


Fig.5. Pawn Movements – AI Pawn

D. Drop-Down Menu

On top left of the UI there is a button which shows a dropdown menu if clicked. The menu has different options and submenus to customize game properties. Fig.6. is the screenshot of the game window with Drop-Down Menu.

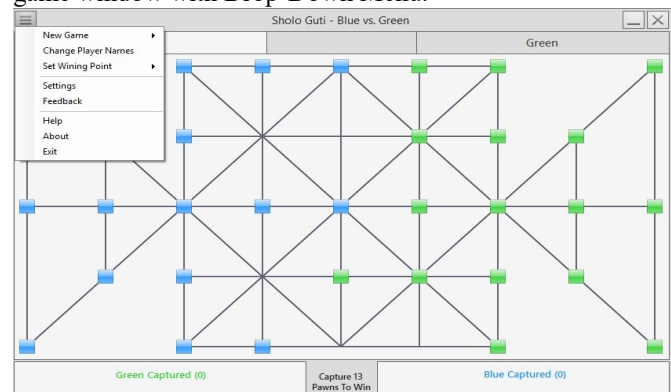


Fig.6. Drop-Down Menu

E. New Game

On dropdown menu there is a submenu named as “New Game” which contains two options to start a new game, “Player vs. Player” and “Player vs. Computer”. On the click to one of those menu option specific game starts with default board. Fig.7. is the screenshot of how to create a new game.

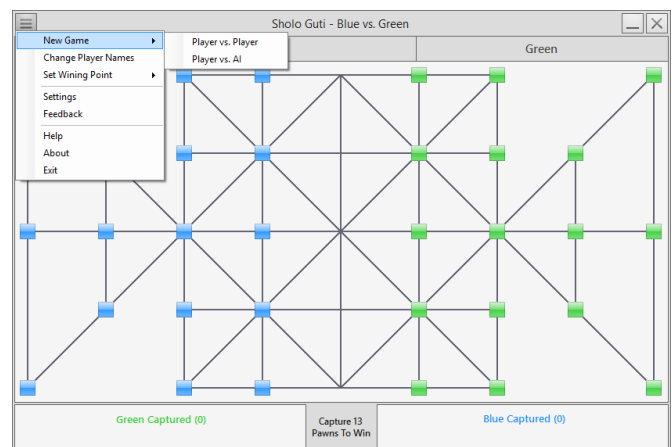


Fig.7. New Game

F. Setting Winning Point

On dropdown menu there is a submenu named as “Set Wining Point”. On the hover to this control, it shows five different numbers. Clicking on any of them sets particular value. Which indicates how many pawns have to be captured by users/computer to win the current game. Fig.8. is the screenshot of how to set wining point on a game.

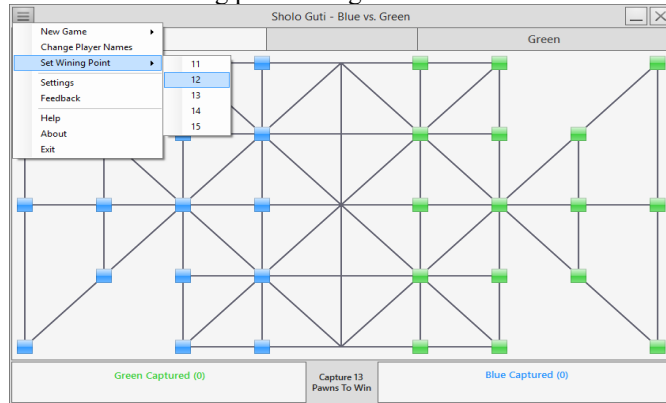


Fig.8. Setting Wining Point

G. Winning the Game

When the specified numbers of pawn is captured by player/ computer, a message box appears on the screen showing the winners name on it. And then another message box is showed up if the player/players wants to start a new game on the current game mode. Fig.9. is the screenshot of what happens when a game is won by the AI and fig.10. is the screenshot of what happens when a game is finished.

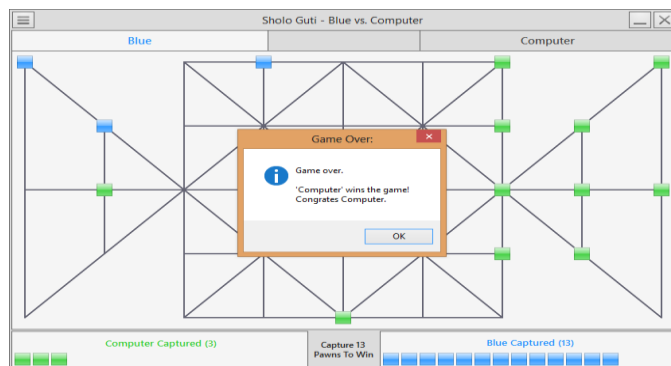


Fig.9. Wining the Game – Game Over

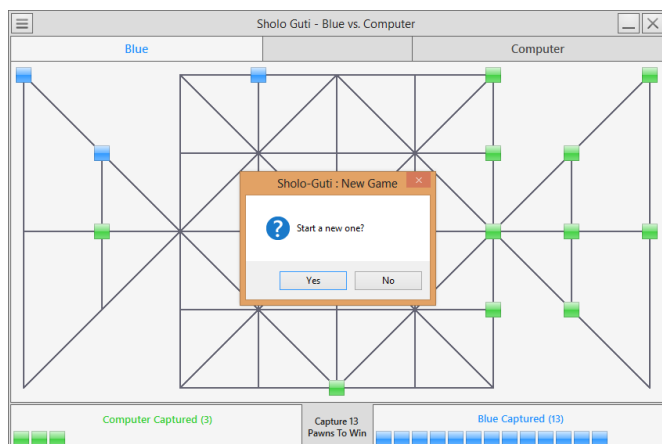


Fig.10. Wining the Game – New Game

H. Save & Exit

When the close button on the top right is pressed or “Exit” is clicked from the dropdown menu, a message box appears to ask player if he wants to save the current game to play it later from the current state. If the button “Yes” is clicked then the game will be saved with current properties. And user can play the game from that saved state when he runs the game next time. Fig.11. is the screenshot of what happens when a close button is pressed during the gameplay.

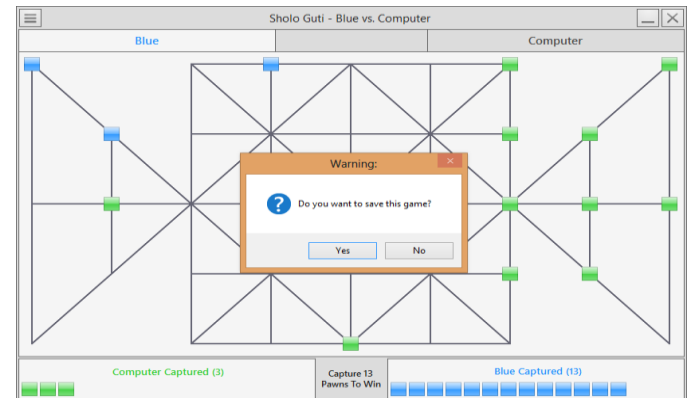


Fig.11. Save & Exit

V. CONCLUSION

Different person thinks differently. This game is developed from a specific point of view and analysis. For developing or designing this game, many problems or difficulties actually came out. So there is a chance that the problems can be solved in a much more easy way by using advanced techniques.

A. Challenges to overcome

It is true that the development environment is totally unpredictable. Many things went wrong while working on the real project. Firstly, any well-defined structure of the game hasn't found. Secondly, Some problems arose while developing the system like creating database cost us more time fetching data from database for this a three dimensional array is used instead of using database. Finally, faced some problem in .NET platform but managed to fix it all.

B. Future scope

We need to apply more algorithms in future to make it more efficient and effective. In future this research can be enhanced into a more intelligent system.

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Analysis of Network Traffic and Security through Log Aggregation

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Abstract—With the tremendous growth in Internet-based applications, there has been a steady elevation in the cyber world based accommodations such as websites, email, web portals, portlets, API etc. With the increase in growth of Internet-based applications, the threat landscape has incremented manifolds. The number of attacks on IT infrastructure has also increased spontaneously. The increase in the infrastructure has posted the assessment of maleficent invasion as a major challenge. To amend the security ecosystem it is desirable to have a complete security solution that covers all verticals and horizontal of the threat landscape. This paper proposes to have a wholesome security ecosystem for the huge amount of websites from malignant attacks and threats, to increase knowledge about traffic patterns and trends and also to perform authentic time decision on maleficent traffic. Log analysis is the art of making sense out of computer-generated records (i.e logs). A technique is evolved for log aggregation and analysis in authentic time through a dashboard and terminal exhibit. It is performed with the help of user interactive displays, real-time alerts are generated based on conditions, and preventive actions can be taken based on those alerts.

Index Terms—Log aggregation, Network Traffic analysis, Network Security, Malicious attack.

I. INTRODUCTION

System trespassing is the act of the unauthorized access of computer systems. It has rapidly become one ecumenical phenomenon. Despite its growing concern, criminological literature has paid least attention to system trespassing [3]. As the distribution systems is becoming the core building block of modern IT industry, it enhances the power of various daily use software, company websites, online shopping platforms, and video sharing services. A transient downtime of the system leading to unavailability of the supported software, enormous revenue losses occur[1], [2]. Thus, a reliable distributed system is highly demanded.

As the computer network technology is developing rapidly, the development of internet technology is faster and people are becoming more conscious of the importance of the network security. It is the prime issue of computing because various types of attacks are increasing day by day[4]. Therefore network security aids in the authorization of access to data in a network, which is controlled by the network admin. It has

become more important for personal computer users, and organizations.

With the advancement of computer networking and increase in Internet-based applications, the number of attacks and potential threats on the web server has also increased to a manifold. They can put individual's computer systems and business computers at risk. This paper provides full protection of infrastructure from these malicious attacks and developing a complete security solution to cater to all vertical and horizontal of the threat landscape. A major challenge and a desirable requirement are to improve the security ecosystem. The paper helps in demonstrating the working of ELK i.e. Elasticsearch, Logstash and Kibana clubbed together to efficiently analyze the log files, providing an interactive and easily understandable insight. Log management system built on ELK stack are advantageous for analyzing large log data sets making the whole computation process easier to monitor through an interactive interface. Being from open source community, ELK stack has many useful features for log analysis. Elasticsearch is implemented as Indexing, storing and retrieval engine. Logstash behaves as a Log input slicer, dicer and output writer while Kibana performs Data visualization using interactive dashboard.

A. INTERNET FIREWALL

Firewalls are designed to protect the network system from external as well as internal threats. The internal network is prevented from the dangers of the internet. It is often installed at points, where the organization wants to protect the internal network connecting to the Internet.

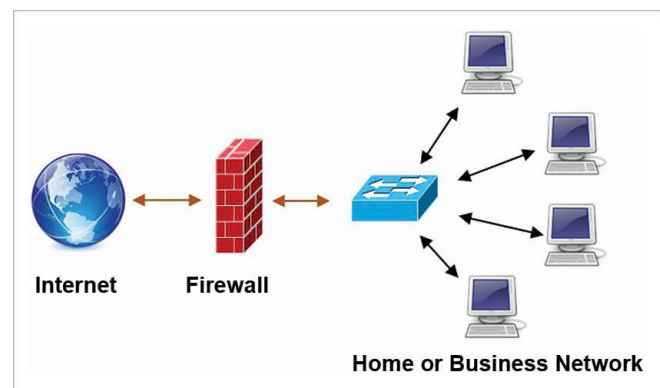


Fig 1.1 Internet Firewall

The traffic coming from the Internet or going out from the internal network passes through this firewall. So the firewall ensures that this traffic is acceptable and secured. Firewall is the central authority for security decisions about all the traffic signals and narrow checkpoint. It gives an enormous amount of freedom for network security decisions, as it concentrates on security measures at this particular checkpoint: the point where the network connects to the Internet.

B. LOG ANALYSIS

Log analysis is used for analysis of computer-generated records that helps organizations and business associates in understanding and actively mitigating its associated risks. Majority of the organizations and businesses needs to perform data logging and log analysis as part of their security and acquiescence [5] regulations. Log analysis helps in minimizing problem diagnosis, resolution time and ineffective management of applications and infrastructure [6]. The main aim of doing the analysis is to find, monitor[8] and measure[9] the anomalies. It also helps in measuring the various capabilities of the firewall that later on would help in enhancing the security in the network.

C. LOG MANAGEMENT

Log management encompasses an approach of dealing with large volumes of computer-generated logs, log messages (also known as audit records, audit trails, event-logs, etc.). Log Management consists of the following: log collection, log analysis, log search and reporting[10].

Network traffic Analysis aids in understanding and evaluation of the network utilization, type, size, origin, and destination of different packets. It provides a clear view for monitoring of uploading/downloading speed, throughput and contents that helps in understanding of different network operations and identifying malicious packets within the traffic flow. With the increase in Internet penetration rate, a huge amount of log files are generated, which contains buried information which are of enormous business values. To unlock these buried returns, log management system helps in making business decisions.

D. ELK

Elasticsearch, Logstash, and Kibana clubbed together efficiently analyze the log files and provides an interactive and easily comprehensible insights. Elasticsearch is used as Indexing, storing and retrieval engine.

Elasticsearch is distributed, multitenant-capable of the full-text search engine with an HTTP web interface and schema-free JSON documents. Elasticsearch is developed in Java and is released as open source under the terms of the Apache License. According to the most popular database engine rankings, Elasticsearch is the most popular enterprise search engine followed by apache which also based on Lucene.

Elasticsearch is developed along with a data-aggregation and log-parsing engine called Logstash, and an analytics and visualization platform known as Kibana. Logstash performs a role of log input slicer and dicer and output writer. Kibana on the other hand performs data visualization using user defined interactive dashboards. The three products are designed to be used as an integrated component, referred to as the "Elastic Stack" (formerly the "ELK stack").

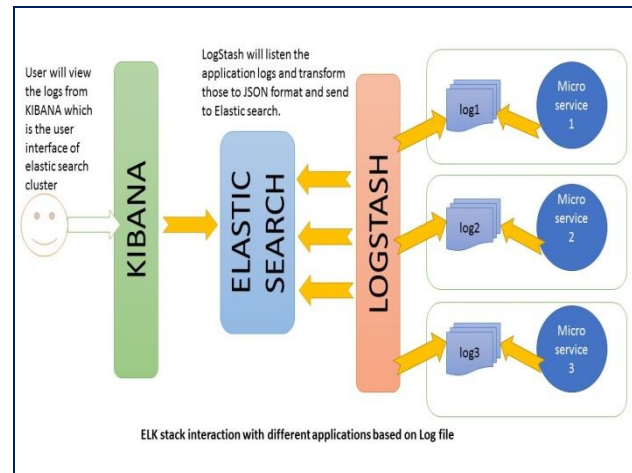


Fig 1.2 Elk Stack

II. RELATED WORK

- *Ibrahim Yahya, Mohammed AL-Mahbash*: proposed that for any organization to provide protection from external threats leading to economic and reputation disaster, log analysis can withal avail in providing bulwark. The systems can reveal affix information, by which data can be extracted that helps in understanding cognizant of the attacks and susceptibilities. For log analysis, ELK stack will receive the forwarded logs from a well-defined commercial safeguard deployed in an authentic environment[11].
- *Sung Jun Son*: uses open source platform, ELK stack to build an astronomically immense security log analysis system for a minute or medium-sized enterprises. It removes the concerns about the installation cost of the commercial product in the commencement stages. Startups are liberated from the efforts of building their own log analysis system with primitive Hadoop, MongoDB, etc. ELK stack shows kindred or better performance in analyzing security logs which match concrete conditions. Compared to Splunk that takes 1min 22.2 seconds for analysis of 1,000 million log file, ELK stacks takes only 1 min and 14.4 seconds. Hence ELK stack can be considered a pursuit for beginning security log analysis with acceptable performance compared to any other high-cost commercial product[12].

- *Tarun Prakash*: The author carries out geo location identification of users based on the access logs using open source stack ELK.. A miniscule log data set is being used to exhibit its usability. ELK stack is a product of the open-source community. The installation steps of the product are less. It is also cost-effective. It has a huge number of active contributor base which enhances its competitiveness when compared to alternative products for log management activities. These features find their usefulness in real Big Data platforms[13].
- *Adrian Perrig, Dawn Song, J. D. Tygar*: ELK members joining events removes the necessity of broadcasting of any data to current group members. The general case engenders minute hint messages that trade-off communication overhead with member computation. These minute clue hints enable genuine receivers to obtain a group key through computation in case a key update message is missed. ELK is one of the first protocols to provide assurance about key update messages without relying on multicast protocols. ELK implements key update footprints encompasses of hints carried inside a data packets. This approach sanctions the majority of the members to recuperate the incipient group key when the key update messages are disoriented[14].
- *Qimin Cao, Yinrong Qiao*: An anomaly detection system for web log files is suggested, that adopts a two-level machine learning algorithm. Normal and anomalous data sets have been classified using decision tree model . The normal data set is manually checked for the establishment of multiple HMMs. The experimental data comes from the real industrial environment where log files have been collected, which contain multiple intrusion messages. After comparing with the three types of machine learning algorithms used in anomaly detection, the experimental results show that system achieves higher detection accuracy and can detect unknown anomaly data.

III. SYSTEM ARCHITECTURE

The first part is done through the deployment of open source firewall and open source packages like Suricata snort which provides the capabilities of packet inspection, intrusion prevention and detection along with secure SSL certificate deployment. Pfsense is an open source firewall/router. It is a computer software distribution that is based on FreeBSD. It is installed on a physical computer or a virtual machine to make a dedicated firewall/router for a network. It can be configured and upgraded through a web-based interface and requires no knowledge of the underlying FreeBSD system to manage. pfSense is commonly deployed as a perimeter firewall, router, DHCP server, DNS server, and as a VPN endpoint.

PfSense supports an installation of third-party packages like Snort or Squid through its Package Manager.

Suricata and snorts are ids packages which can be installed with pfsense. Suricata inspects the network traffic using a powerful and extensive rule and sign language and has powerful Lua scripting support for detection of complex threats.

An open document sharing application is deployed as the web server on apache hardened platform with base OS as Ubuntu. The document sharing application can simply be deployed on the server.

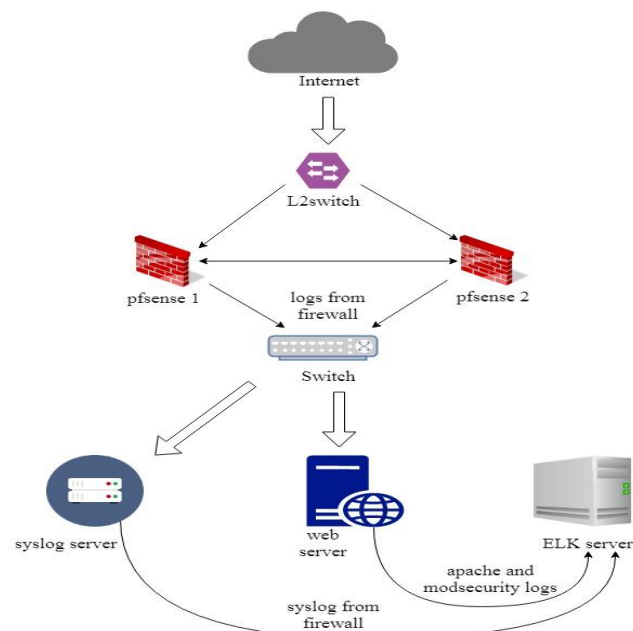


Fig 1.3 Basic Architecture

To provide web application capabilities an open source mod_security shall be deployed and alert is raised as soon as some unusual activity is detected. Alert or alarm specifies the system administrator that system is being attacked or is under attack. The alerts can take the form of audible signals, email messages, pager notifications or pop-up windows.

The second part is performed through the deployment of syslog server in the network. All log analytical algorithms are written in python along with few web-based displays. The program helps in analyzing logs and extracting important fields and information. The raw logs are converted into a user understandable format and displayed using dashboard and terminal display using kibana.

For the development of security, various types of logs are been taken:

1. Syslog: It tells about the messages generated by the software.
2. Authorization logs: It gives information about the users who all have accessed the system.
3. Firewall logs: It gives information about the traffic coming to the firewall.
4. Apache logs: It tells information about the data requested by the respective users.
5. IDS logs: It gives information about the malicious attacks happening on the server.

Steps were taken for parsing of logs:
Type: Firewall logs

```
Mar 14 09:18:11 10.10.12.1 filterlog: 112,,,100000101,bce2,natch,pass,in,4,0x0,,64,0,0,DF,17,udp,60,10.10.12.231,8.8.8.8,60890,53,40
Mar 14 09:18:11 10.10.12.1 filterlog: 81,,,1000006962,bce1,natch,pass,out,4,0x0,,63,0,0,DF,17,udp,60,14.139.154.121,8.8.8.8,8932,53,40
Mar 14 09:18:12 10.10.12.1 filterlog: 112,,,100000101,bce2,natch,pass,in,4,0x10,,64,0,0,DF,17,udp,76,10.10.12.231,91.189.89.198,42601,123,51
Mar 14 09:18:12 10.10.12.1 filterlog: 81,,,1000006962,bce1,natch,pass,out,4,0x10,,63,0,0,DF,17,udp,76,14.139.154.121,91.189.89.198,12956,12
Mar 14 09:18:13 10.10.12.1 filterlog: 94,,,1770008761,bce1,natch,block,in,4,0x0,,244,54714,0,none,6,tcp,40,5.108.86.39,14.139.154.121,51514
Mar 14 09:18:13 10.10.12.1 filterlog: 94,,,1770008761,bce1,natch,block,in,4,0x0,,241,9113,0,none,6,tcp,40,77.72.83.235,14.139.154.121,51851
```

Fig 1.4 Raw logs

Step 1: Python code is developed which will extract out important fields from the raw logs.

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	date	time	hostname	mo	tid	realInterface	reason	action	direction	version	tos	ttl	id	offset	flags	pid	protocol	length	sourceip	destip	srcport	dstport
1	Mar-27	4:39:08	10.10.12.1	85	1000000862	hce1	match	pass	out	4	0x0	63	0	0	DF	17	udp	76	14.139.154.121	13.126.27.171	20807	123
2	Mar-27	4:39:09	10.10.12.1	113	1529004996	hce2	match	pass	in	4	0x0	64	0	0	DF	17	udp	76	10.10.12.237	91.189.89.198	37286	123
3	Mar-27	4:39:09	10.10.12.1	85	1000000862	hce1	match	pass	out	4	0x0	63	0	0	DF	17	udp	76	14.139.154.121	91.189.89.198	60439	123
4	Mar-27	4:39:10	10.10.12.1	113	1529004996	hce2	match	pass	in	4	0x0	64	0	0	DF	17	udp	55	10.10.12.162	8.8.8.8	38070	53
5	Mar-27	4:39:10	10.10.12.1	85	1000000862	hce1	match	pass	out	4	0x0	63	0	0	DF	17	udp	55	14.139.154.121	8.8.8.8	59063	53
6	Mar-27	4:39:10	10.10.12.1	113	1529004996	hce2	match	pass	in	4	0x0	64	0	0	DF	17	udp	77	10.10.12.237	8.8.8.8	37002	53
7	Mar-27	4:39:10	10.10.12.1	85	1000000862	hce1	match	pass	out	4	0x0	63	0	0	DF	17	udp	77	14.139.154.121	8.8.8.8	8002	53
8	Mar-27	4:39:10	10.10.12.1	113	1529004996	hce2	match	pass	in	4	0x0	128	26225	0	none	17	udp	64	10.10.12.161	8.8.8.8	62590	53
9	Mar-27	4:39:10	10.10.12.1	85	1000000862	hce1	match	pass	out	4	0x0	127	47532	0	none	17	udp	64	14.139.154.121	8.8.8.8	15201	53
10	Mar-27	4:39:11	10.10.12.1	113	1529004996	hce2	match	pass	in	4	0x0	64	0	0	DF	17	udp	77	10.10.12.237	8.8.8.8	40032	53
11	Mar-27	4:39:11	10.10.12.1	85	1000000862	hce1	match	pass	out	4	0x0	63	0	0	DF	17	udp	77	14.139.154.121	8.8.8.8	13007	53
12	Mar-27	4:39:11	10.10.12.1	113	1529004996	hce2	match	pass	in	4	0x0	64	0	0	DF	17	udp	77	10.10.12.237	8.8.8.8	34636	53
13	Mar-27	4:39:11	10.10.12.1	85	1000000862	hce1	match	pass	out	4	0x0	63	0	0	DF	17	udp	77	14.139.154.121	8.8.8.8	57802	53
14	Mar-27	4:39:11	10.10.12.1	113	1529004996	hce2	match	pass	in	4	0x0	64	0	0	DF	17	udp	58	10.10.12.237	8.8.8.8	54065	53
15	Mar-27	4:39:11	10.10.12.1	85	1000000862	hce1	match	pass	out	4	0x0	63	0	0	DF	17	udp	58	14.139.154.121	8.8.8.8	12771	53
16	Mar-27	4:39:11	10.10.12.1	113	1529004996	hce2	match	pass	in	4	0x0	64	0	0	DF	17	udp	77	10.10.12.237	8.8.8.8	40037	53
17	Mar-27	4:39:11	10.10.12.1	85	1000000862	hce1	match	pass	out	4	0x0	64	0	0	DF	17	udp	77	14.139.154.121	8.8.8.8	7400	53
18	Mar-27	4:39:11	10.10.12.1	113	1529004996	hce2	match	pass	in	4	0x0	64	0	0	DF	17	udp	77	10.10.12.237	8.8.8.8	38032	53
19	Mar-27	4:39:11	10.10.12.1	85	1000000862	hce1	match	pass	out	4	0x0	63	0	0	DF	17	udp	77	14.139.154.121	8.8.8.8	62094	53
20	Mar-27	4:39:12	10.10.12.1	113	1529004996	hce2	match	pass	in	4	0x0	64	0	0	DF	17	udp	58	10.10.12.237	8.8.8.8	57029	53
21	Mar-27	4:39:12	10.10.12.1	85	1000000862	hce1	match	pass	out	4	0x0	63	0	0	DF	17	udp	58	14.139.154.121	8.8.8.8	15203	53
22	Mar-27	4:39:12	10.10.12.1	113	1529004996	hce2	match	pass	in	4	0x0	64	0	0	DF	17	udp	58	10.10.12.237	8.8.8.8	39701	53
23	Mar-27	4:39:12	10.10.12.1	85	1000000862	hce1	match	pass	out	4	0x0	63	0	0	DF	17	udp	77	14.139.154.121	8.8.8.8	38032	53
24	Mar-27	4:39:12	10.10.12.1	113	1529004996	hce2	match	pass	in	4	0x0	64	0	0	DF	17	udp	77	10.10.12.237	8.8.8.8	32093	53
25	Mar-27	4:39:12	10.10.12.1	85	1000000862	hce1	match	pass	out	4	0x0	63	0	0	DF	17	udp	77	14.139.154.121	8.8.8.8	4963	53
26	Mar-27	4:39:12	10.10.12.1	113	1529004996	hce2	match	pass	in	4	0x0	64	0	0	DF	17	udp	77	10.10.12.237	8.8.8.8	34630	53
27	Mar-27	4:39:12	10.10.12.1	85	1000000862	hce1	match	pass	out	4	0x0	63	0	0	DF	17	udp	77	14.139.154.121	8.8.8.8	35589	53
28	Mar-27	4:39:14	10.10.12.1	113	1529004996	hce2	match	pass	in	4	0x0	64	0	0	DF	17	udp	58	10.10.12.237	8.8.8.8	34032	53

Fig 1.5 Output

Step 2: Logstash filter is developed for extracting information from the output generated in the previous step.

```
filter {
  csv {
    separator => ","
    columns => [ "date", "time", "hostname", "rulenum", "tid", "realInterface", "reason", "action", "direction", "version", "tos", "ttl",
    "id", "offset", "flags", "pid", "protocol", "length", "sourceip", "destip", "srcport", "dstport" ]
  }
  geoip {
    source => "sourceip"
    target => "geoip"
    add_field => [ "[geoip][coordinates]", "%{[geoip][longitude]}" ]
    add_field => [ "[geoip][coordinates]", "%{[geoip][latitude]}" ]
  }
  mutate {
    convert => [ "[geoip][coordinates]", "float" ]
  }
  mutate { convert => [ "hostname", "integer" ] }
  mutate { convert => [ "rulenum", "integer" ] }
  mutate { convert => [ "tid", "integer" ] }
  mutate { convert => [ "version", "integer" ] }
  mutate { convert => [ "ttl", "integer" ] }
  mutate { convert => [ "id", "integer" ] }
  mutate { convert => [ "offset", "integer" ] }
  mutate { convert => [ "pid", "integer" ] }
  mutate { convert => [ "length", "integer" ] }
}
```

Fig 1.6 Logstash Filter

Step3: The logs are now displayed in kibana in a user-friendly interface with an index to each column.



Fig 1.7 Kibana display

The flow diagram for the proposed system is as follows:

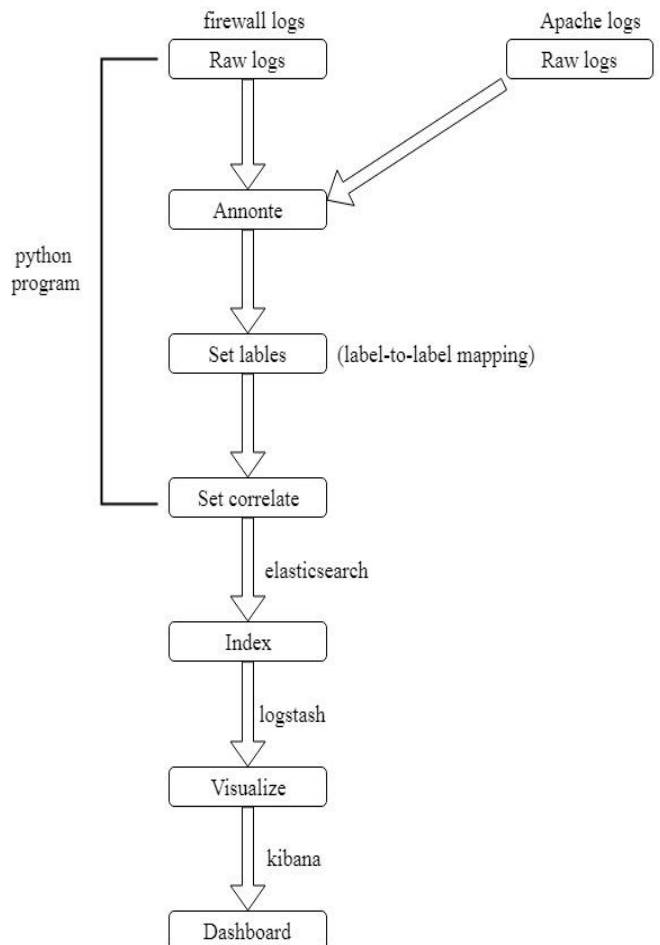


Fig 1.8 Flow diagram for the system architecture

An algorithm for analysis of logs for security is developed. In this algorithm separate functions are created for different type of logs and it compares respective fields from each type of logs with a defined threshold value, and if it violates the threshold, then the specific ip is marked as an malicious ip, all such malicious ips are stored in an specific text file for the admin for future use. And also the location of each malicious ip is being determined for admin for information purpose.

Algorithm

1. Import threading and pygeoip package
2. In main() call analyze()
3. Begin analyze()
 1. Open "attack.txt" file to write the output
 2. Define ipquery(ip)
 1. Return country name of Ip
 3. Define refine()
 1. Open filter log file in read mode
 1. Define parse(line)
 2. Extract relevant information and write in CSV format to a file
 3. End
 4. Read each line from a log file and call parse(line)
 4. End refine()
 5. Define ips()
 1. Open ips log file in read mode
 2. Define parse(line)
 3. Extract relevant information and write in CSV format to a file
 4. End
 5. Read each line from ips log file and call parse(line)
 6. End ips()
 7. Define apache()
 1. Open apache log file in read mode
 2. Define convert(line)
 3. If a system file is being fetched
 1. Store source_ip in the dictionary and increase count by 1
 4. End convert()
 5. Define match(line)
 6. If a status is "block"
 1. Store source_ip in a dictionary and increase count by 1
 7. End match()
 8. Read each line from apache log file and call convert(line)
 9. Read each line from apache log file and call match(line)

10. For every key in a dictionary
 1. If a value is greater than a predetermined threshold
 2. Write key to "attack.txt" for system file access violation
11. For every key in a dictionary
 1. If a value is greater than a predetermined threshold
 2. Write key to "attack.txt" status code violation
8. End apache()
9. Define malicious()
 1. Open ipscsv file in read mode
 2. Define detect(line)
 1. If "attack" or "bad" in classification then
 2. Store source_ip in dictionary and increase count by 1
 3. End detect()
 4. Read each line from ipscsv file and call detect(line)
 5. For every key in dictionary
 1. If value is greater than a predetermined threshold
 2. Write key to "attack.txt" for system file access violation
10. End malicious()
11. Call refine()
12. Call ips()
13. Call apache()
14. Call malicious()
15. Make a thread to call analyze() every 30 minutes
16. Send email containing attack.txt to system admin
17. Start thread
4. End analyze()

IV. RESULTS

Log monitoring system used for aggregating all kinds of logs in a central location, providing an ease of analysis, storage, and organizing. Event log monitoring with Security Information (SIEM) can detect threats in real time, allowing responses to be made before deleterious conditions persist. One of the main challenges of manually parsing logs is its multiple different formats that exists, starting from syslog to SNMP traps, to IIS W3C logs and Windows events. All this

can be dealt with Event log monitoring that focuses on what happened, and allows the applications not to worry about the what format in which it was recorded. It aids in finding out what is happening across diverse systems.

Event log monitoring makes it easier for a single admin to govern logs coming from multiple servers and applications in the environment, ensuring nothing is left and that the admin has all the information for addressing any requirement. Event log monitoring is the best approach for proactive management. Data visualization provides a lot of business advantages such as real-time data — fresh and accurate, one-time cost investment which saves from human resources and human mistake. File logs are handled with Filebeat. It tracks changes in log files and sends all new log records as soon as it appears in the file. As the logs from user interface cannot be stored in a file, they are sent to our host with HTTP requests. After that, it is stored in Elasticsearch. The IP addresses are very valuable for each request. Each address is converted to appropriate geographical coordinates and parsed onto the map. Server metrics are collected with the help of Metric beat shipper to get a better grip on of enormous data stores which contains point-and-click pie charts, bar graphs, trend lines, maps and scatter plots. Various trends and patterns can be visualized for vivid data sets that would otherwise become extremely tedious to understand and deduce. Eventually, business associations can make practical use of this collected data that helps in customizing the dashboards. Hence, quick and smart communications can be obtained by saving, sharing and linking the data in an interactive visualization.

All the types of logs are parsed using the same steps. Based on the information available in kibana an interactive dashboard containing useful visualization such as pie charts, graphs, a map showing the location of IPs are created.

Log analysis is done for finding out various attacks which are happening on the server or website. A program written in python is created which continuously analyse the logs and based on various conditions like IP count in a specific time period, client accessing system files, information about the attack given by the IDS logs etc, alerts are being generated in the form of email which is sent to the admin giving information about the respective attacks, and all those client IPs are being recorded in a specific file for the admin for future use.

The threshold values which are used for comparison purpose can vary from system to system. The exact value of threshold depends on the system admin based on the amount of data stored and the rate of traffic being generated by the system.

The alert generation process is done in real time, along with the log analysis process, it can also be done on hourly or daily basis depending on the system and on the administrator. Alerts can be generated in various forms like email, slack, console depending on the system admin.

The output of the algorithm after running the algorithm for a specific period of time looks like this:



Fig 1.9 Output of the algorithm

The Dashboard gives an interactive and meaningful insight about the logs which can be useful for the admin for analyzing the whereabouts.

Visualizations created in kibana dashboard:

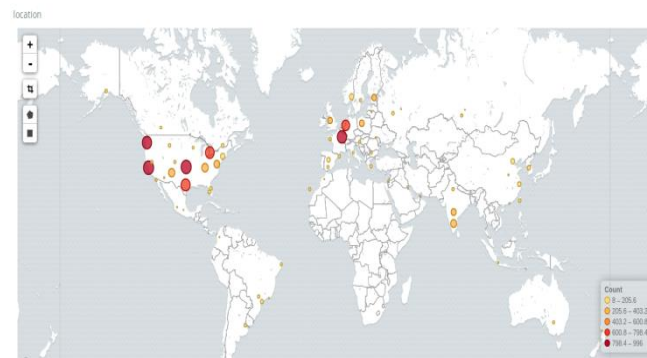


Fig 1.9 Geo-identification



Fig 1.10 Analyzing of client OS

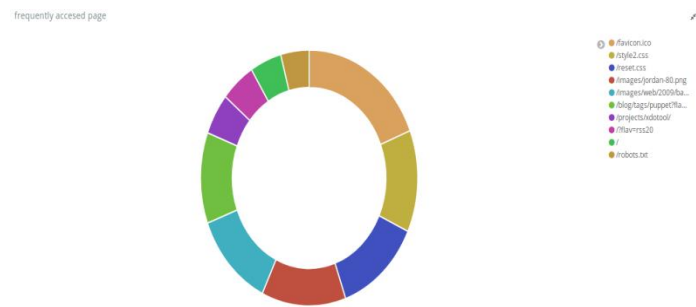


Fig 1.11 Frequently accessed pages

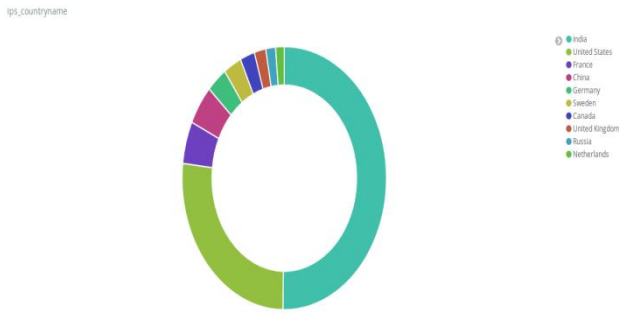


Fig 1.12 Hits per country

V. CONCLUSION

The proposed system thus helps in evolving a technique for log aggregation and analysis in real time through the dashboard and terminal display, and alerts are generated based on various malicious conditions. Analysis of the Log Results and updating of Firewall Based on the outcome of Log, alerts generated and deployment of complete Server Security System. Log analysis helps in Security attentiveness and quick detection of failed processes, determining trends and data stored in data archive and facilitates dynamic data streaming. Visualization in kibana helps in understanding the threat landscape and enabling decisions to strength it. It also helps in identifying the gaps and loopholes through plots.

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K-Means Clustering in Moving Objects Extraction with Selective Background

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Abstract - We presents a technique for moving objects extraction. There are several different approaches for moving object extraction, clustering is one of object extraction method with a stronger teorical foundation used in many applications. And need high performance in many extraction process of moving object. We compare K-Means and Self-Organizing Map method for extraction moving objects, for performance measurement of moving object extraction by applying MSE and PSNR. According to experimental result that the MSE value of K-Means is smaller than Self-Organizing Map. It is also that PSNR of K-Means is higher than Self-Organizing Map algorithm. The result proves that K-Means is a promising method to cluster pixels in moving objects extraction.

Keywords : extraction, clustering, moving object.

I. INTRODUCTION

The video application areas automated visual observation of a person or group, content-based visual image analysis, video tagging, and a mutual human-computer are facing important and bold problem which is moving object extraction. The video segmentation process must be successfully taken before we move to next processes such as extraction process on feature, identification, and the basic cognitive process of arranging into categories.

The video moving objects extraction process is aimed to separated into parts an image sequence into typically particular areas which is able to enclose significant labels afterward, in which a set of region is broken down with the exact same one and similar kind attributes such as pixel degree, a visual attribute, motion. Problems of moving objects extraction have been discussed in many literature, in which according to their primary approaches is roughly classified into three categories, they are: dissimilar temporal [1] [2]; motion optical flow [3] [4] [5]; and background difference.

The initial mode for analysing the frame sequence in video is through background model in [6] that compose in maintaining recent shape of moving objects from the background element. The background model is useful for segmenting video streams of the background to foreground.

The background subtraction is commonly applied to moving object recognition, which contains in upholding an update archetype of background and perceiving moving objects as those that diverge from such an archetype. In the comparison to other oncoming, for example optical flow in [8], this oncoming is feasible for the actual time that applications takes a process to occur by computation process.

Based on the background subtraction in [9], we determines to apply selective background in moving object extraction. In this paper, we assess the performance of clustering algorithm for extraction in moving objetos.

II. RELATED WORK

An efficient background registration technique algorithm for efficient segmentation moving object have proposed in [10], this method was applied to structure consistent background from collected different frame motion information. This technique separates area by comparing the existing frame from the structured background.

A vigorous foreground partitioning algorithm have presented in [11], this approach is used to put into group whether it includes in the part of a scene behind objects in the foreground or employed a several intensity and refine a distinguishing information which having structure process in the later.

The consistent foreground segmentation approach have projected in [12], researchers incorporate temporal image analysis and recommendation background frame to overcome the glitch occurs on outdoor daylight sections which cause adjustment of the intensities on the background recommendation image of moving object segmentation. The purpose of using transient image analysis is to discover the object in every frame whether it is moving or static that emerged problem in background model.

Other approaches have been used in [13], the method combines two video segmentation technique using key-frame retraction and object-based method which have

been constructed for effective and robust based video segmentation algorithm and statistical clustering.

III. REVIEW OF RELATED THEORY

In this section, we describe of how extraction- moving objects based on clustering technique between K-Means and Self-Organization Map algorithm are presented.

a. K-Means Algorithm

The k-means algorithm is a hard clustering technique that divides the objects into k clusters, until each objects are being clustered to one and only one membership to minimize the sum of squared distances between each data point and the empirical mean of the corresponding cluster.

Algorithm 1: K-Means Algorithm

- 1) Select objects to be k initial centroid randomly
- 2) Estimate the distance of each centroid of each object by using space or similarity metric; use nearest centroid point to define each object at the cluster.
- 3) Calculate the latest centroid point.
- 4) Observe the result. If it turns to be different from the previous one, then return to step 2

3.2 Self-Organization Map Algorithm.

Self-Organization Map (SOM) is an iterative algorithm in [16] [17] and one of the widely used algorithm for clustering. SOM comprises the competitive and cooperative stage

Algorithm 2 : Self-Organizing Map algorithm

1. Initialize the learning rate α , radius of the neighbor function r and random values for the initial weight $w_{ij} \in W$
2. Repeat until α reaches 0
 - a. For $k=1$ to n
 - b. The competitive stage: for all $w_{ij} \in W$ find the winning neuron that minimize $d_{ij} = \|x_k - w_{ij}\|$
 - c. The cooperative stage: renew each unit $w_{ij} \in W$: $w_{ij} = w_{ij} + \alpha h(w_{winner}, w_{ij}, r) \|x_k - w_{ij}\|$
 - d. Lessen the rate of α and r

IV. CLUSTERING-BASED OF MOVING OBJECT EXTRACTION

In this section, we describe of how to extract moving object by using clustering techniques modelling. In each frame, there are steps which is necessary by to perform moving object extraction and it is shown in Fig. 1. The sub steps are described below:

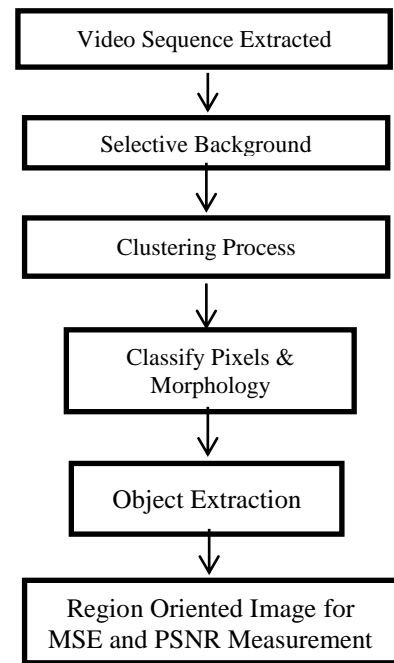


Figure 1. Diagram of Extraction Moving Object

a. Background Subtraction

In case of our background model with selective background is applied to detect the intensity different of current and background image. we adopt double different method also known three different method [18]. In the early stages video files are captured and broken into digital images based on video frames.

The extraction process is performed on a video where for each frame in a certain time unit is converted into digital image form. Digital imagery is generated in the form of JPEG (Joint Photographic Experts Group). Next to each pixel in the digital image is converted to a double type that has a range of values between 0 and 1.

The pixel value 0 for the weak colour component and the value of 1 means a strong colour component. Although converted into a double type, but the digital image is still in the RGB colour domain.

This following step of background subtraction with selective background:

1. Extract all frames on the video
2. Search for background frames automatically by calculating the mode values in each frame

3. Convert Current Frame and Background Frame to grayscale image
4. Reduce between the two frames
5. Convert the resulting image to binary image
6. Perform morphological operations to eliminate noise
7. Make image of morphological operation result as masking to visualize moving object

The result of background subtraction with selective background can show in figure 2.

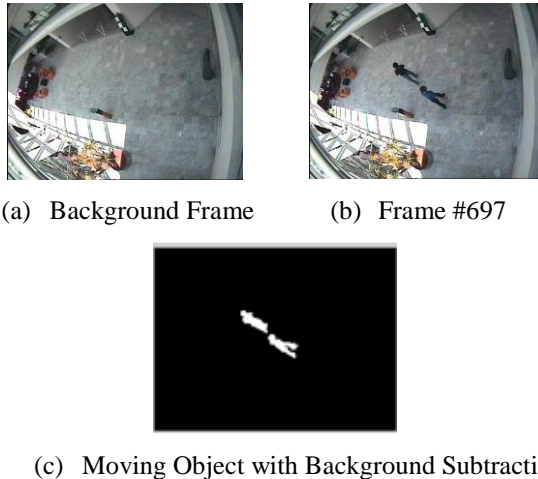


Figure 2. Result of object detected with Background Subtraction

b. Clustering using K-Means, SOM Algorithm

In this stage, we used two methods for moving object extraction and tracking which is in parallel process between SOM and K-means. Two different dataset have been used in each experiment for moving object extraction.

c. Morphology

A better extraction result is significant, so it needs morphology in the performance [19]. In the manipulation process of image features, morphology is applied which is based on shape [20], using basic operation such as dilatation, erosion, opening, and closing. Sequential combination of dilatation and erosion is presented in opening and closing. In [21], it is stated that the aim of opening process erosion which is followed by dilatation is encircling corner from inside the objects to obtain filter detail and simplified images. Meanwhile, small gaps within the object are closed by the closing (dilatation followed by erosion). This paper applies closing to eliminate the flawed in foreground recognition.

d. ROI Cropping for measurement

This stage is processed to create image ground truth, where as the human operation is cropping region of

interest image reference in moving object clustering for comparing the performance of moving object extraction to calculate the MSE and PSNR.

V. EXPERIMENTAL RESULT

a. Data and Results

Algorithms implemented in the process of moving objects extraction was having an experimental result aimed for image sequences. It had been proved in the performance of the proposed method is tested in a sequence of moving images in real video. We defined two sequences which represented significant standard situations for video surveillance systems. The video processing was applied on moving objects in which the goal intended to be attained extracted moving objects in the building. We utilized Matlab software ver. 2017b and RAM on PC with processor i3-6100, 3.70 GHz, with memory 4.00 GB.

1) Sequence Walk1 : Sequence Walk1 of the database CAVIAR Project¹ was labeled and comprise 611 frames of 484 x 288 in spatial resolution, acquired at frequency 25 fps. It was an example of difficult sequences, where the lighting condition was not as clear as previous area and the moving human tended to cover-up the path.

2) Sequence Walk2 : Sequence Walk2 of the 2nd database CAVIAR project was labelled and comprised 700 frame of 388 x 288 in spatial resolution, attained at frequency 25 fps. We have been assigned to test the method capability to segmenting more than one moving object. Finally, we found that K-Means was quite successful in moving objects extraction.

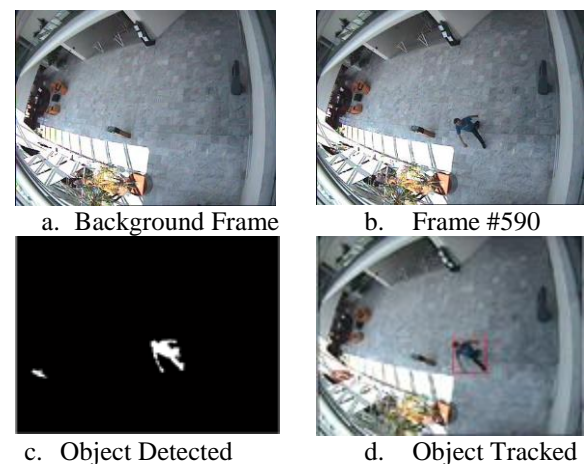
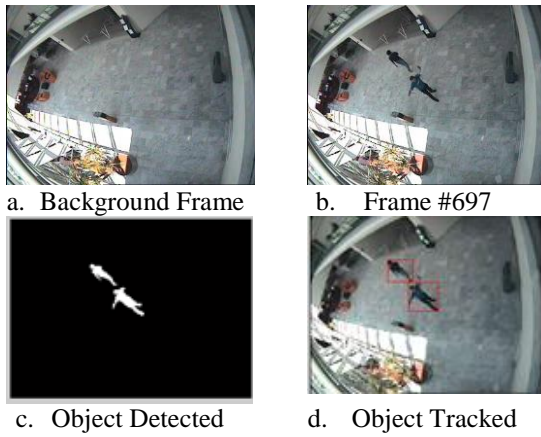


Figure 3. Result of moving object extraction using K-Means (Walk1 dataset)

¹ <http://homepages.inf.ed.ac.uk/rbf/CAVIAR/>



In which R represents ground truth image, Q represents extraction frame of size $M \times N$ and \max is image maximum achievable pixel value-.

Figure 4. Result moving object extracted using K-Means with Rest_WiggleOnFloor dataset.

b. Performance Evaluation

In the measurement of performance in the process of moving object extraction, Mean Square Error (MSE) and Peak Signal to Noise Ratio (PSNR) were applied. Both measurements are used for calculate the altered quality that renders of extracted and ground truth of image frame [22] in which better image segmentation was by having lower value of MSE and higher value of PSNR [23]. Those values of MSE and PSNR were obtained by the measurement process using [12] and [23], respectively.

$$MSE(R, Q) = \frac{1}{MN} \sum_{h=1}^M \sum_{j=1}^N [R(h, j) - Q(h, j)]^2 \quad (1)$$

$$PSNR(R, Q) = 10 \cdot \log_{10} \left(\frac{\max^2}{MSE(R, Q)} \right) \quad (2)$$

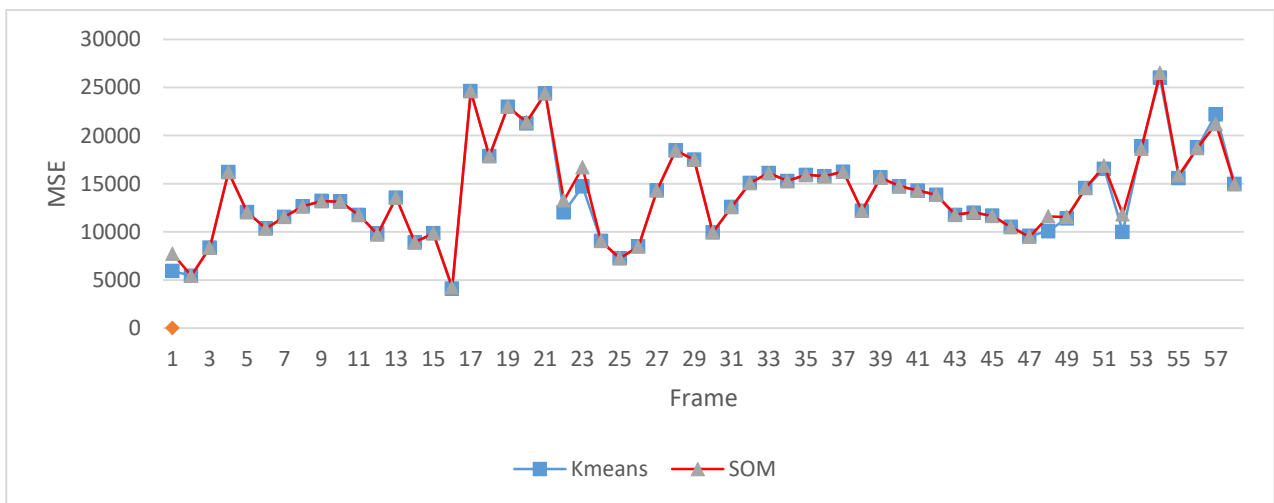


Figure 5. MSE of Walk1 Dataset using K-Means, SOM

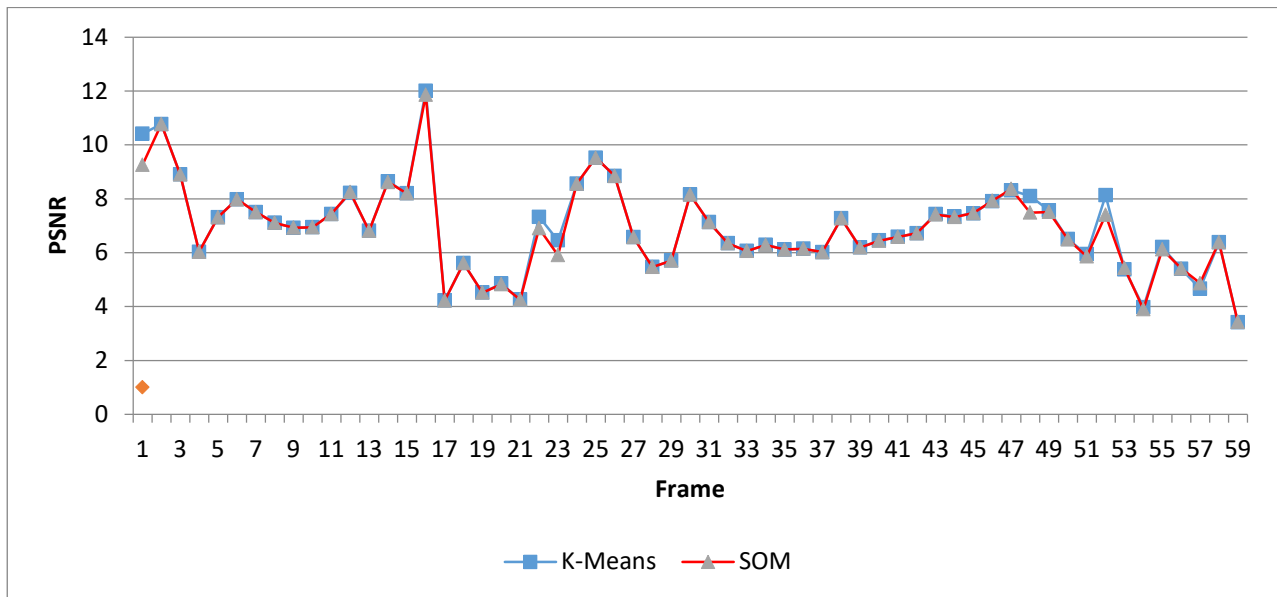


Figure 6. PSNR of Walk1 Dataset using K-Means, SOM

In two video used, we evaluated the comparison of object moving extraction. They are, video of human walking sequence in hall, and two people walking from same direction. Table 1 and Table 2 showed the MSE and PSNR of two video using K-Means and Self Organizing Map algorithm. K-Means produced better extraction result.

TABLE 1. Average MSE of K-Means and SOM

No.	Dataset	K-Means	SOM
1	Dataset1	13.83	13.97
2	Dataset2	9.7	9.80

The MSE of K-Means was having result that was lower than the MSE SOM, and the PSNR was higher than the PSNR of SOM. Fig. 4 and Fig. 5 illustrated the MSE and PSNR of dataset Walk1, correspondingly.

TABLE 2. Average PSNR of K-Means and SOM

No.	Dataset	K-Means	SOM
1	Dataset1	6,93	6,87
2	Dataset2	8,66	8,66

VI. CONCLUSIONS

We presented study of moving object extraction by using clustering techniques. Based on the results of research and experiments that have been done, it can be

concluded that background subtraction techniques with a selective background to produce a good detection process. In static environments with indoor locations where the intensity of the lighting is relatively fixed, the background used can be manually modelled. However, in an environment with dynamic conditions, an adaptive background to environmental conditions is required. This research can also detect pedestrian objects quite well only by using selection techniques based on the size of the object. To improve accuracy, a comparison technique can be performed with pre-prepared training data. In addition, based on the results of trials that have been done, the proposed method

The outcome showed which the achievement of object moving extraction using K-Means is better than SOM algorithm. K-Means generated smaller MSE and greater PSNR opposed to SOM.

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VMware pulse IoT center, an IoT management suite

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Abstract— Internet of things is one of the catch words now a day. It promises a great future for the internet. Today common types of communications are person to person, machine to person, or person to machine. But Internet of things brings a new technology where a type of communication is machine to machine. Many technology and protocols have been studied for this new communication. One of the new and emerging technologies is VMware Pulse IoT center which provides IoT device management in a pretty manner. It serves as management glue between hardware. This paper will take a look on features, benefits and working of VMware pulse IoT center including summary of IoT solutions by VMware pulse IoT center.

Keywords—Internet of things, VMware pulse, IoT center.

I. INTRODUCTION

The notion of Internet of things was first given by **Kevin Ashton** in 1999 [1]. The term “internet of things” is not clearly defined and has been used and miss used as a buzz word of scientific research, marketing and sales strategies [2]. One definition has recently been sketched in the Strategic Research Agenda of the Cluster of European Research Projects on internet of things [2]. (CERP-IoT 2009); “Internet of Things (IoT) is an integrated part of Future Internet and could be defined as a dynamic global network infrastructure with self configuring capabilities based on standard and interoperable communication protocols where physical and virtual ‘things’ have identities, physical attributes, and virtual personalities and use intelligent interfaces, and are seamlessly integrated into the information network. In the IoT, ‘things’ are expected to become active participants in business, information and social processes where they are enabled to interact and communicate among themselves and with the environment by exchanging data and information ‘sensed’ about the environment, while reacting autonomously to the ‘real/physical world’ events and influencing it by running processes that trigger actions and create services with or without direct human intervention. Interfaces in the form of services facilitate interactions with these ‘smart things’ over the Internet, query and change their state and any information associated with them, taking into account security and privacy issues.”

The internet of things is here and the data generated by the millions of connecting things is helping enterprises improve business agility, create efficiencies and deliver better customer experiences but is enterprises embrace IoT the one of the challenge; management, security and scale, which can further

amplify by disconnect operational technology (OT) which owns assets, the sensors and Information Technology (IT) who must secure in managerial? VMware has the solution to address all of these challenges. VMware pulse IoT center is an enterprise great IoT device management and monitoring solution that enables both OT and IT to Onboard, Manage, Monitor and secure their IoT use cases from the edge of available cloud. It all starts with LIOTA a little IoT agent which is an open source SDK that resides on connected things and edge gateway. It helps to collect the information of sensors being managed and delivers OTA (on the air) software and security updates. It also provides a single pane of glass for IT and OT users to manage all of their IoT use cases. OT tracks the status in health of connected devices while IT manages complete software and firmware lifecycle. With pulse IoT centers, we can define and view metrics and alerts, monitor the health of IoT devices to identify anomalies in real time and take preset actions if required. Pulse IoT centers provides over the year security updates and patches. It also supports on-prem deployments to address privacy in governance. VMware pulse IoT centers extends VMware’s digital trends for major expertise to the edge of your business where your IoT infrastructure resides.

It’s a survey paper. We took a survey with in a city to review the common business man’s opinion on VMware pulse IoT center’s benefits. According to their, it’s a very helpful app where IoT will has horizontal use cases that could apply across all the organizations. With this point of view, it will definitely be used to gain profit in the business as both OT and IT will have a single pane of glass for their device management.

II. WHY VMWARE PULSE IOT CENTER

“Reference [3] declares that VMware pulse IoT is not about VMware and AirWatch, as both are separate things. However VMware pulse IoT borrows some features from AirWatch for the 3 tier IoT environment. IoT is not just about the sensors, it also about the scope as well. IoT is limited to OT which is a disappointing thing that’s why IoT has not any horizontal use cases which could apply on all organizations.” IoT have many solutions in market but all of these need much effort and time consuming deployment. Sometimes there are no adapters for the sensors and such solutions do not work well at different edges or devices. VMware is taking a new approach to IoT with the latest launch of VMware pulse IoT center. By providing security and end to end infrastructure management,

VMware pulse IoT center enables OT and IT to manage, secure and monitor all IoT devices from the edge to the cloud. To help customer for addressing complex IoT use cases across different industries, VMware is forging alliances related to IoT with;

- Server OEMs/Edge Systems
- Embedded OEMs
- Systems Integrators
- Business Applications and Analytics
- IoT Platform Vendors

Some examples of partners of this project are [4]:

- Dell
- Herman
- Deloitte.
- Pivotal
- IBM
- Viz Explorer
- Microsoft and others.

III. PULSE IOT CENTER WITH LIOTA

LIOTA stands for “little IoT agent” is an open source SDK provides some kind of ease to the developers of IoT solution developers to create IoT edge system for data orchestration [5].

For VMware pulse IoT center, LIOTA is a client side module, resides of edge gateways or embedded things. It transmits data to the VMware pulse IoT center console back in the cloud or data centers. Through LIOTA, developers can deliver their innovation by building secure IoT gateway applications for data orchestration and control between edge devices and data centers. Many organizations want to take full advantages of IoT applications but they couldn't do so because of a big challenge of interoperability [6]. This situation appears because of the lack of common communication protocols and data aggregation protocols between edge devices as well as network protocols [6]. So it is needed to create an app that could support interpretability. One step to this direction is 3-tier architecture, which connects edge devices to the data centers via intelligent gateways [6]. A diagram of 3-tier architecture is shown below in Fig.1

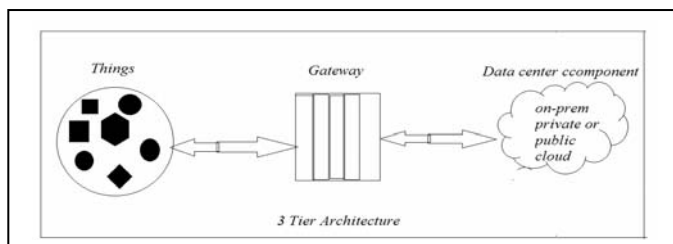


Fig.1

These gateways are intelligent hub but problem with diverse IoT devices is being unable to understand different languages, is still persist with this architecture. To overcome this issue LIOTA comes up with a common model for unified data acquisition and orchestration [6]. It provides interaction between any IoT device and any data center component over any transport and through any IoT gateway or edge system. It has been successfully tested with many gateways and cloud components from both VMware and community such as VMware pulse IoT center [6].

Features

Some key features of LIOTA are as follows [7];

- The underlying hardware system (board)
- Hardware with the operating system (gateway)
- Connected devices ('Things')
- A transformer abstraction (for formatting and analysis of metrics)
- Transport abstractions for connection to the data-center
- DCCs (data center components)
- Alerts, metrics and actions.

Design goals [7]

- *primary design goals*
- simplicity
- easy to use
- simple installation and modification

A. *secondary design goals*

- generality
- modularity
- quality

Key components

Liota has abstractions which correspond to a complete data flow from a device attached to the edge system to an application in a data-center [7];

- **Connected Device** represents a device or any entity attached to or on an IoT gateway.
- **DeviceComms** is an abstraction of the communication mechanisms between a device and an edge system.
- **Edge System** represents the hardware and software platforms of an IoT gateway or edge system.
- **Metric** represents a time-series stream from a data source to a datacenter application.
- **Data-Center Component** is an abstraction of the protocol and format a data-center component requires.

- **DCCComms** is an abstraction of the communication mechanisms between the edge system and data-center. These components are shown below in Fig.2

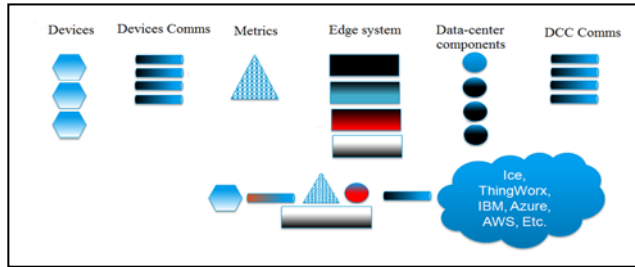


Fig.2

Liota Dynamic Packages

Package Manager allows the loading and unloading of Liota packages. A liota package is a Python class having [7]:

- A dependency list (of other packages)
- Code to obtain configuration from registry and references to objects from other packages
- A run method
- A cleanup method

IV. FEATURES OF VMWARE PULSE IoT CENTER

A. Setup

It is highly scalable and supports many of sensors and actuators means IoT connected devices [8]. It provides solution for deployment; security and flexibility. Its future version will be offered as cloud hosted [8].

B. Enterprise Integrations

It can also be integrated with existing monitoring system [9].

C. Monitor

It can identify irregularities or unusual things with real time monitoring. It can also analyze the infrastructure [8].

D. envision the things

It provides topology representation of infrastructure, 2 tier or 3 tier, in a parent child relationship diagram.

E. Flexible rules engine

It also defines what, where and when things are updated.

F. Edge device management system

IoT is a large collection of different connected devices. VMware pulse IoT center can manage different connected things and gateways with different hardware, communication protocols and operating system. It also provides single point of management for both OT and IT [8].

G. Smart data orchestration

It can transport data where and when it is desired across the edge and into the cloud by integrating into enterprise system.

H. Security

It provides security at devices, network and user level with software updates and with VMware identity manager integration [8]. Pulse IoT centers provides over the year security updates and patches. Through this, network can also wipe the compromised gateway [8].

Availability

Channel partners and customers can work with Dell Technologies and Microsoft to purchase this solution in the second half of 2018 [10].

V. COCLUSION

With the growing technology, Internet of things has become a first choice for many organizations. IoT is a very wide field having emerging technologies with diverse and complex landscape and these technologies needs complex solutions and much effort too. IoT seems to be limited only to OT which is a disappointing thing as it has not any horizontal use cases which could apply across all organizations. VMware pulse IoT center provides solution over this issue by allowing both OT and IT to have complete control over their form the edge all the way to the cloud. Pulse IoT center provides different features like monitoring, on boarding, security and management. It all starts with LIOTA, a little IoT agent. For VMware pulse IoT center, LIOTA is a client side module, resides of edge gateways or embedded things. It transmits data to the VMware pulse IoT center console back in the cloud or data centers. Through LIOTA, developers can deliver their innovation by building secure IoT gateway applications for data orchestration and control between edge devices and data centers. However LIOTA can work with any OS that support Python. So for future enhancement, it should support other languages too.

VI. ACKNOWLEDGMENT

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Gait Recognition for Security and Surveillance System- A Review

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Abstract— Gait is the style of walking or limb movement of a person. Gait recognition is a biometric technology that is based on behavioral features of human. It finds applications in different areas such as banks, military, airports, and many other areas for threat detection and security purposes. Biometric gait recognition is a popular area of research as it is an unobtrusive process to recognize a person. In the current paper we review several approaches of gait recognition, discuss their advantages and disadvantages and then show directions for future research.

Keywords- gait, biometric feature, silhouette, neural network and support vector machine.

I. INTRODUCTION

Security is an important issue in modern world. Recognition of a person is an important necessity for ensuring a secured environment. For these reasons automated human identification is very essential for the detection of threats, critical infrastructure, surveillance and access control. To cope with unauthorized access, we are witnessing three different generic systems: knowledge-based, object-based and biometric-based recognition [1]. Among these, biometric system has got attention of the public eye because it can effectively identify people using physiological or behavioral trait, which are God-gifted and really unique for each person [2]. For detecting and recognizing individuals there are many biometric features such as hand-written signature, face, fingerprint, iris, palm print, gait or some combination of these features [3]. Among these, gait – the way of walking or limb movement of a person is relatively a new biometric trait. Every person has unique characteristics of moving leg. By identifying the movements of each person, we can easily recognize him or her. The unique advantage of gait biometric is that it is unobtrusive and can be captured from long distance which gives the ability to recognize from far distance and at low resolution [2-3, 4].

Some strategies have already been developed, hence the main objective of this paper is to review the existing methods of gait recognition along with their merits and demerits and also to show ways for future research on gait recognition.

The remainder of the paper is structured as follows. Section II describes the gait recognition methods and section III critically discusses the pros and cons of existing techniques and gives some guidelines for future research directions. Finally, section IV concludes the paper.

II. GAIT RECOGNITION METHODS

Fig. 1 shows the generic flow diagram of gait recognition [5], which mainly consists of three steps: (i) preprocessing and background subtraction for silhouette extraction from the original frames, (ii) gait feature extraction, (iii) analysis and recognition.

A. Recognition by PCA

Liu et al. [6] used an adaptive silhouette extraction algorithm to segment the gait images and then performed a series of postprocessing to obtain the normalized silhouettes with less noise. They proposed a feature extraction method based on outermost contour. Finally, for recognition of gait principal component analysis (PCA) [7] and multiple discriminant analysis [8] have been applied.

Chen and Gang [9] proposed a method for human gait identification based on difference image. Gaussian distribution-based background estimation has been used to segment frames of the sequence to obtain noise immune silhouette images. They compared the difference of two adjacent silhouettes in the sequence. They produced one walking cycle by projecting every difference image of the whole walking images. Then two-dimensional PCA is used to transform the above walking cycle to two vectors keeping the maximum separability. Finally, the similarity of two human gait images is calculated by the Euclidean distance of the two vectors.

Chourasiya et al. [10] developed a novel approach which is based on gait energy image and PCA to recognize the person from their gait sequence such as normal walk, with backpack, with gown and hands in pocket. Then the authors have taken the mean (average) of the images and applied PCA to reduce the feature extraction time and increases the recognition rate.

Babak et al. [11] developed a strategy in human gait recognition by making templates and produced subspace projection of templates by PCA method. Finally, multilayer perceptron (neural network) is used for gait recognition.

Amer et al. [15] proposed a statistical gait recognition technique using Gabor features. They produced gait energy image from the gait sequence and then convolved with a Gabor filter bank of 8 different orientations and 5 different scales. Support vector machine is applied on Gabor features to measure the gait similarity and identify the individual.

Ira and Paramjit [16] have used Hanavan's model for gait recognition. This model calculates the distance between head and feet, distance between both hands, length of one hand, length of leg, etc from silhouettes. Then content-based image retrieval [17] strategy along with multi linear discriminant analysis and BPNN (back propagation neural network) has been used for training and testing the method. Fig. 4 shows the recognition method of system.

C. Recognition by neural network and fuzzy logic

Jang-Hee and Doosung [18] proposed a method for gait recognition using BPNN. In their approach, a 2D stick figure is extracted from gait silhouette for representing the gait signature. After that final recognition is done by BPNN algorithm. Fig. 5 shows the human gait signature.

Sanjeev et al. [19] proposed a method for gait recognition through generation of silhouette by background subtraction as shown in Fig. 6. Then center of mass, step size length, and cycle length features are used for gait recognition using neural network.

Dong Xu et al., [20] proposed a gait recognition method based on a matrix representation. At first, binary silhouettes over one gait cycle are averaged for which each gait video sequence contains a number of gait cycles that was represented by a series of gray-level averaged images. The authors then applied unsupervised algorithm named as coupled subspace analysis. At last, a supervised algorithm named as discriminant analysis with tensor representation, is applied for gait recognition.

Jyoti and Gupta [21] proposed a method for gait recognition that is based on fuzzy classification. For gait recognition the authors consider human body joint, for example, shoulder and feet in which they got enhanced recognition rate.

D. Recognition by Euclidean distance vector

Jyoti and Gupta [22] presented graph-based technique for extraction of gait feature. They found that the shortest distance cannot be same for person to person because of diverse repeated motion of the body part-palm, knee, ankle, inclination and toes. By calculating the shortest distance through Euclidean distance they performed the gait recognition.

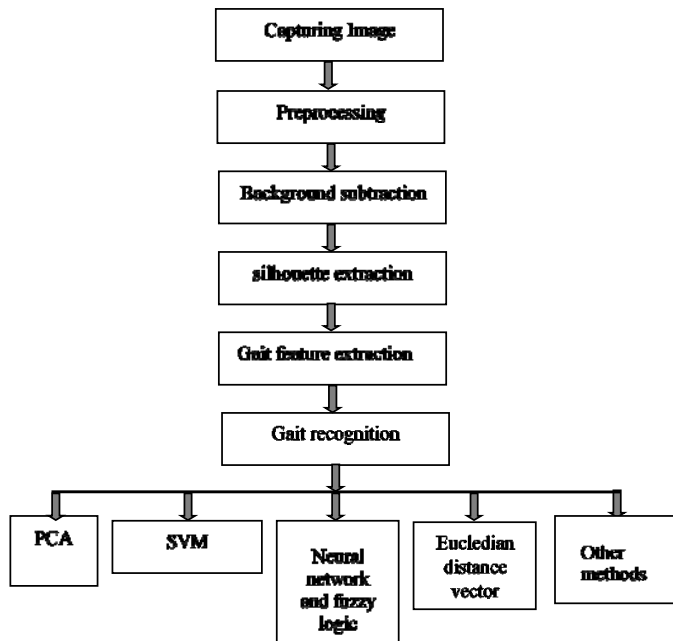


Figure 1. Flow diagram of gait recognition

Hayder et al. [12] used Radon transform to detect features within an image and then the used PCA for dimensionality reduction transformed images.

B. Recognition by SVM

Joshi et al. [13] used Gaussian mixture model for foreground object estimation from input video sequences and then applied median filter to remove impulse noises. After that they used moving target classification algorithm to separate human being from other foreground objects and extracted feature vectors. Finally, the authors performed recognition of individuals by applying hidden Markov model, back propagation neural network and support vector machine.

Hu Ng et al. [14] developed a method for extraction of human gait features from silhouette. Then they performed a smoothing operation on extracted features. Finally, used fuzzy k-nearest neighbor, linear discriminate analysis and linear support vector machine for gain recognition. Fig. 2 shows original image and silhouette image. Fig. 3 presents entire extracted gait features.



Farida and Mir [23] applied time series analysis based on auto regressive modelling technique for identification of a person. They performed the recognition based on the

difference of Euclidian distance between feature vector of test samples and training samples.

Fazenda et. al. [24] described a gait recognition method using average silhouette of a person over a gait cycle. They used the binary silhouette of a walking person by subtracting the background. Then the silhouettes are aligned and averaged over each gait period. Recognition is done by the Euclidean distance of a person with respect to the average silhouette of a number of persons.

Iman and Jan [25] developed a gait recognition method using gait energy image and Radon transform of the silhouette image. The recognition is performed using the similarity of Euclidean distance of the two images.

Kale et al. [26] proposed a view-based approach by calculating the Euclidean distances of a given image from the different instances a walking cycle. of a person. Then they used continuous hidden Markov model to train and recognize the gait. The statistical nature of the hidden Markov model ensures the overall robustness of gait recognition.

Hosseini and Nordin [27] developed a Euclidean distance-based approach for recognizing a person from gait video. They confirmed its effectiveness through a bench-marked TUMIITKGP Gait Database [28].

E. Recognition by other methods

Xiaxi and Nikolaos [29] investigated a set of silhouettes to extract gait features such as area, center of gravity and the orientation of body components for gait recognition.

Purohit and Mukesh [30] formulate a framework to estimate the view angle of each gait sequence. Then they used dual-tree complex wavelet transform (DTCWT) and Hough transformation to extract gait features. Finally, SVM is used for gait recognition.

Andersson and Araujo [31] proposed a method for gait recognition using anthropometric gait data which are tracked by a Microsoft Kinect device. Fig. 7 shows the mechanism of their approach.

Liang et al. [32] proposed a simple gait recognition algorithm based on Procrustes statistical shape analysis. Finally, they used k -nearest neighbor classifier and the nearest exemplar classifier on Procrustes distance for gait recognition.

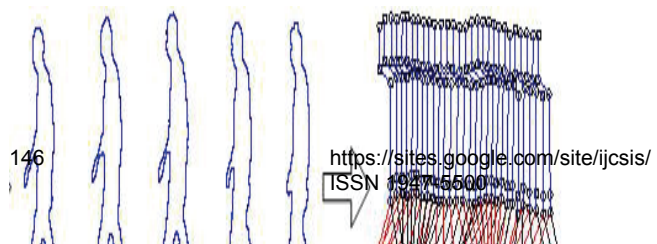
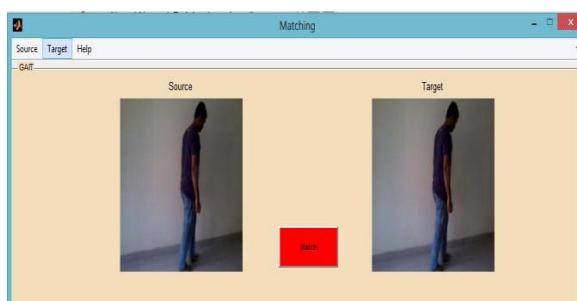
Femila and Precila [33] developed a method for gait recognition from self-occlusion. They extracted the self-occluded feature from the silhouette image sequences.

Chih-Chang et al. [34] described a multiresolution motion energy histogram-based approach for recognition of human gait.

Worapan et al. [35] proposed sparse regression-based view transformation model (VTM) for gait recognition under various views. The specialty of their approach is that it is free from the problem of overfitting.

Junxia et al. [36] proposed a method for gait recognition using a markerless pose recovery method through capturing 3-D human joint and pose parameters from gait sequence.

Nini et al. [37] proposed a method for view-invariant gait recognition using joint subspace learning method based on simple nearest neighbor rules.



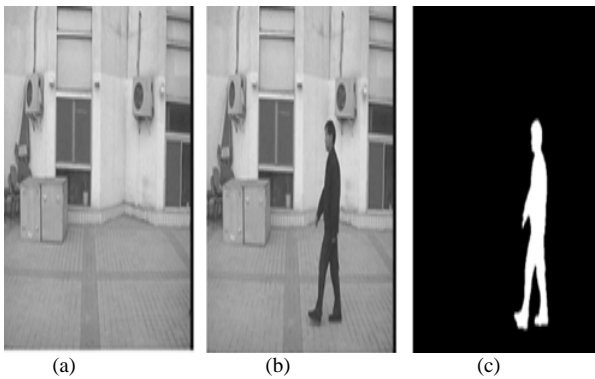


Figure 6. Example of gait detection. (a) Background image; (b) Original image; and (c) Extracted silhouette (taken from references [19]).

III. DISCUSSIONS

A. Critical comments on recognition by PCA

The accuracy of the authors [6] algorithm is 97.67%. But they did not specify the drawbacks of their algorithm.

The accuracy of the proposed method [9] can achieve 92%. But method is sensitive to silhouettes segmentation and the matrix alignment method may lose some useful information. Divya et al. [10] tested the method using TUMITKGP dataset [28] by 35 subjects. The efficiency of the algorithm may be increased by ease of analysis of patterns in the data.

Babak et al. [11] got 97% accuracy by testing their method using only 10 persons which is questionable. Hayder, et al. [12] got recognition above 95% using principal component analysis with and without Radon transformation for different walking styles. The results were compared with other published papers and reported that the proposed system gives efficient result.

B. Critical comments on reecognition by SVM

Joshi, et al., [13] did not describe the performance of their proposed method. Authors of reference [14] obtained recognition accuracy 84% by experimenting on only 11 image sequences.

The methods mentioned in references [15] and [16] claiming that these are performing better but they did not described the data elaborately.

C. Critical comments on recognition by neural network and fuzzy logic

Jang-Hee and Doosung [18] claimed 90% accuracy by experimenting with only for 30 subjects.

Sanjeev et al. [19] claimed 96.32% accuracy by experimenting with only for 25 subjects. This can be combined with other biometric systems. Dong Xu, et. al. [20] did not describe about the performance and the data.

D. Critical comments on recognition by PCA

Jyoti and Gupta [22] obtained the recognition rate of 95% for rank 5 and 75% for rank 1 CASIA database, respectively.

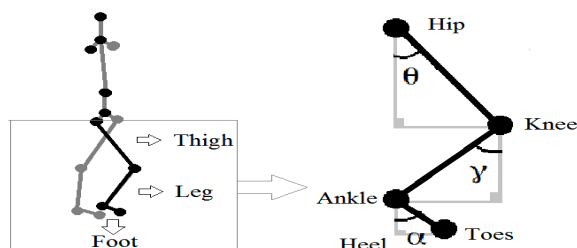
Authors of reference [22] obtained 99.11% accuracy. But it needs more experimentations for validation of such high accuracy.

Fazenda et al. [24] obtained accuracy of 95%. The authors should do experiment with more diverse data. The gait recognition method of Iman and Jan [25] is invariant to rotation; however, they did not specify the performance of their method.

The method developed by Negin and Jan [27] is sensitive to appearance of the subject; however, it is simple.

E. Critical comments on Recognition by other methods

The performance of the experimental results of the proposed method [29] is better compared to the existing methods that used manually-extracted silhouettes.



Experimental results of the method proposed in reference [32] showed that its performance is encouraging.

The Worapan et al. [35] gait recognition method experimented on widely adopted gait database and obtained somehow good results.

Nini et al. [37] found good recognition rate compared to the conventional methods. But it did not specify the used data for experimentation.

The limitations of the current gait recognition methods are as follows:

1. All methods used small number of data for gait recognition.
2. The performance of the existing methods is not up to the mark if experimented with diverse gait situations.

F. Future research directions

We have reviewed a number of research papers and found that there is a good number of benchmarks in gait recognition. But still there are limitations of these research. So, the future researcher should concentrate on:

- a) The performance and effectiveness of the existing systems is questionable due to huge variations in gait. Researcher should concentrate on developing systems for gait recognition for good performance and effectiveness.
- b) The researcher should develop hybrid system as well as dual/triple stage recognition for the effectiveness of the system.
- c) The researchers should also focus on developing novel approaches overcoming the demerits of the existing methods.
- d) Generative adversarial search (GAN) is very promising technique for developing diverse models mimicking diverse gait situations. Hence, it has potentiality for developing highly accurate gait recognition technique.

IV. CONCLUSIONS

We have reviewed the present status of gait recognition system. There are many methods have already been developed such as PCA, SVM, neural network and fuzzy logic, Euclidean distance vector, etc. The performance of these existing systems are not up to the mark and has not commercially as well as effectively used in real life scenario. We have shown some research directions for further improvement. Finally, we can say that researcher should concentrate on developing novel, multi-stage, robust approaches for gait recognition.

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Image Stitching Algorithm: An Optimization between Correlation-Based and Feature-Based Method

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Abstract—Image stitching detects several images of the same scene and then merges those images to generate a single panoramic image. This paper presents a framework to compare different kind of panorama-creation process, such as correlation-based method and feature-based method with a view to develop an optimum panorama. The evaluations are done by comparing the outputs with respect to the original ground truth along with computation time. We have done simulations by applying these two approaches to draw a satisfactory resolution.

Keywords—panorama; image stitching; image features and feature detection; correlation

I. INTRODUCTION

Image stitching is a mechanism for forming panoramic images. We know that over-lapping regions of input images may produce visible seam between images which is caused by the disparities in camera responses and illuminations of scene and errors in spatial alignment. Image stitching is a technique to locate and remove the seams of the overlapping areas of the input images and then blend together [1].

There are many methods to produce stitched image. Image stitching is less hardware-intensive but mostly software-based mechanism to generate a wide field of view image. It captures many regular pictures to cover up the whole viewing space and stitches together all the images to build a single image with a larger field of view [2]. Image alignment or registration of images, is a prerequisite for image stitching. Alignment or registration is the process of finding correspondence considering rotation, translation and scaling between two images of the same scene.

The categories of image stitching techniques can be generally classified into intensity based- or direct- and feature-based-method. Direct method is very functional for stitching images which have no overlapping region. Feature based method can be functional in small overlapping region. Image stitching using correlation is one of the most primitive stitching techniques, which is basically an intensity-based approach and suitable for images with overlapping or non-overlapping region [3], [4]. To establish correspondences among a set of images, feature correspondence between two or

more images are considered necessary, so, it is essential to identify a set of prominent points in each image [5].

In image registration, it is compulsory to align two or more images of a scene. The major steps, concerned in image registration or alignment tasks are: (i) feature detection; (ii) feature matching based on transformation functions using corresponding features in images; (iii) reconstruction of images using derived transformation function. For matching and recognition, the first step is to detect location of interests in the images. Then descriptors are computed and these need to be compared to find the association between images for matching operation. So, we should use feature detector and a feature descriptor for extracting features from images [6], [7].

The main objective of this paper is to give a guideline for optimum stitching to fulfill the satisfaction on diverse applications. We have structured the rest of the paper as follows: Section II describes literature review. In Section III, we have presented a brief depiction of the stitching algorithms. In Section IV, we have performed the performance evaluation on the obtained results. We discussed about applications of image stitching algorithms in Section V. Finally, we have turned the conclusion of the paper along with some future research directions in Section VI.

II. LITERATURE REVIEW

Many researchers have already been worked on image stitching. A thorough review on image stitching is presented below:

Yang et al [8] proposed an image mosaic method based on phase-correlation and Harris operator. Wang et al [9] presented an automatic panoramic image mosaic method based on graph model.

Adel et al [10] proposed an image stitching system based on ORB (Oriented FAST (Features from Accelerated Segment Test) and Rotated BRIEF (Binary Robust Independent Elementary Features)) technique and compensation blending. Szeliski [11] proposed a method of image alignment and stitching. Fatah et al [12] had a proposal of automatic seamless of image stitching method. Quiet al [13] presented an algorithm based on SIFT

(Scale Invariant Feature Transform) based feature matching and transformation parameters. Ostiak et al [14] presented a fully automated HDR (High Dynamic Range) panorama stitching algorithm where he used the SIFT based algorithm for the recognition of the corresponding feature points.

All methods have merits and demerits. With this view, in the current paper we have performed a comparative study on feature based- and correlation based-method to develop an optimum image stitching approach on the basis of application perspective.

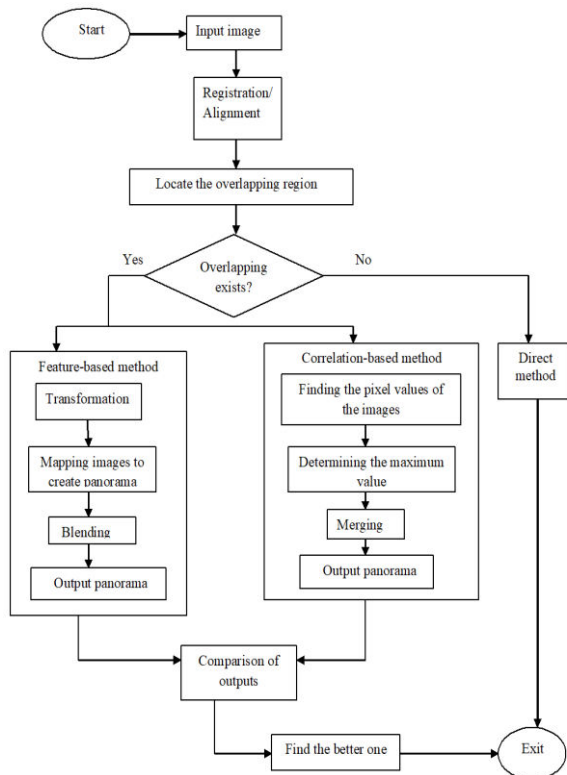


Figure 1. Flow diagram of our methodology.

III. METHODOLOGY

The methodology consists of the following steps:

A. Image Acquisition

The first step is acquisition of images which means capturing images by camera devices or acquiring from secondary sources.

B. Alignment

The reason of alignment is to locate are liable alignment parameter which can decrease the miss-registration between every pair of images. It is very useful to widen the pair wise matching criterion [15], [16].

So, here, we need to detect and match features between images $I(n)$ and $I(n-1)$. Then, we have to estimate geometric transformation T that maps images $I(1)$ to $I(n)$ as follows [17], [18],

$$T = T(1) \times T(2) \times T(3) \times \dots T(n-1) \times T(n) \quad (1)$$

In Eq. (1), $T(1), T(2), T(3), \dots, T(n-1), T(n)$ are the geometric transformations of images $I(1), I(2), I(3), \dots, I(n-1), I(n)$, respectively.

C. Locating Overlapping Region

Locating the overlapping region is the next step. This is essential for the consequent features between several images [20], [21]. If the overlapping region exists, then we can have two types of output: feature-based panorama and correlation-based panorama. But, if overlap does not exist, our method stitches the images directly one after another one.

D. Feature-Based Stitching

Generally, for creating panorama, one image is selected as the reference and then all the images are sequentially used for stitching. The result is often known as a flat panorama [22], [23].

Image stitching can be applied on several projective layouts, for example, rectilinear projection, where the panorama is observed lying on a plane (two-dimensional) crossing a pano-sphere at a point [24]. Rectilinear projection uses cube faces with cubic mapping for viewing panorama and it demonstrates a cylindrical projection [25], [26].

After plotting the source pixels against the ultimate composite surface, it is necessary to blend them for creating a panorama. Therefore, blending operation is a prerequisite for image stitching. Feathering, image pyramid and gradient domain are some familiar blending procedures [27]. Blending operator forms a blend of two input images of the same size [28], [29]. Feathering is used for blurring the edges of features. From the two overlapping images, the average pixel values are evaluated for the blended regions. Multi-band image blending is another well-known method that executes in the gradient domain [30], [31], [32].

These magnitudes are used such that the output pixel values do not surpass the highest pixel value.

The resulting image $Q(i, j)$ is calculated using the formula,

$$Q(i, j) = X \times P_1(i, j) + (1 - X) \times P_2(i, j) \quad (2)$$

In Eq. (2), P_1 and P_2 are the two input images. In some applications, X may also be a constant, thus allowing a constant offset value to be added to a single image. X is the blending ratio which determines the control of each input image points into output. X can either be a constant factor for all pixels in the image or can be determined for each pixel separately using a mask. The size of the mask must be identical with the size of the images [33].

E. Correlation-Based Stitching

We do not need to extract features in correlation-based stitching approach. This process depends on the relation between two images. It is variant to rotation, scaling and other

transformation. For accurate preprocessed images, correlation approach is efficient to apply.

Determining the correlation values is the first step in this method. Matching interest points in two un-calibrated images is fundamental problem in computer vision. Correlations generally used in many applications that require matching parts of the images [34], [35], [36]. We have calculated correlation coefficient r between two images A and B using the following equation,

$$r = \frac{\sum_m \sum_n (A - A')(B - B')}{\sqrt{(\sum_m \sum_n (A - A')^2)(\sum_m \sum_n (B - B')^2)}} \quad (3)$$

In Eq. (3), $A' = \text{mean}(A_{mn})$ and $B' = \text{mean}(B_{mn})$.

After determining the maximum correlation value of the two images we have to find the maximum degree of column vector [37], [38].

Merging is the next step. When the source pixels are mapped onto the final surface, then these are blended in order to generate a panorama and the seam line adjusted to reduce the visibility of seams between two images[39], [40],[41].

F. Comparison

In this step, Feature-based panorama and Correlation-based panorama are compared with the Ground truth. The approach will move forward with the better result depending on the optimization of accuracy.

IV. RESULTS AND DISCUSSIONS

We applied our method on ten-image set and each image set consists of two images as inputs. We have prepared two input images (480×475 pixels each, for image set 1 to 8) from some original images using Microsoft Office Picture Manager. Besides these, we also used input images of other sizes (500×475 pixels for image set 9 and 700×475 pixels for image set 10). All these images have some overlapping regions as well as repetitions. Then, we have inputted these images to create the panorama using stitching techniques: feature-based panorama and correlation-based panorama [39]. All the outputs are generated using MATLAB R2017a with Microsoft Windows 10 platform, Intel Core i3, 2.00 GHz processor and 4.00GB RAM. During experimentation, we found that feature-based method consumes more time but correlation-based method takes less time. So, if these two methods are compared in term of speed, the correlation method is faster. Accuracies for the

both methods are almost similar, as the images are mostly aligned from the initial stage. Figure 2 shows an image (which is used as a ground truth for the stitched image). This image is cut into two images with some overlapping and shown in Figure 3. Figure 4(a) shows the registration process on the basis of feature points. Figure 4(b) shows the overlapping region. Figure 4(c) presents the stitched image using correlation-based method and Figure 4(d) shows the stitched image for feature-based method. Similar to Figures 2-4, we have done the same operations in Figures 7-9 for an HDR image and in Figures 10-12 for a microscopy image. Figure 5 shows two images without any overlap region and Figure 6 presents its corresponding stitched image by direct method (simple stitching).

TABLE I. PERFORMANCE EVALUATION OF IMAGE STITCHING TECHNIQUES BASED ON ACCURACY RATE AND TIME

Input Image and its size	Correlation-based Method		Feature-based Method	
	Accuracy (%)	Time (Sec)	Accuracy (%)	Time (Sec)
Image Set 1 (480×475)	98.61%	0.3937s	96.44%	0.7166s
Image Set 2 (480×475)	98.86%	0.4672s	96.36%	0.9883s
Image Set 3 (480×475)	99.62%	0.4596s	98.16%	0.9081s
Image Set 4 (480×475)	99.71%	0.4011s	98.82%	0.8092s
Image Set 5 (480×475)	99.79%	0.4222s	99.05%	0.9951s
Image Set 6 (480×475)	99.09%	0.5716s	97.43%	1.6230s
Image Set 7 (480×475)	99.29%	0.8725s	98.53%	1.0128s
Image Set 8 (480×475)	99.29%	0.7938s	97.13%	1.7026s
Image Set 9 (500×475)	98.60%	0.7674s	96.65%	1.1427s
Image Set 10 (700×475)	99.59%	0.7571s	98.52%	0.9608s

We have used the following equation to calculate the accuracy:

$$\text{Accuracy} = 1 - \frac{\sum(\sum(|I_1 - I_2|))}{\sum(\sum(I_1))} \quad (4)$$

In Eq. (4), I_1 is the original image, I_2 is the resultant image of the experiment. Table I shows the performance (accuracy and computation time) of the stitching method.



Figure 2. Original image (treated as ground truth panorama)



Figure 3. Two input images which are generated from the original image of Fig. 2 with some overlapping.

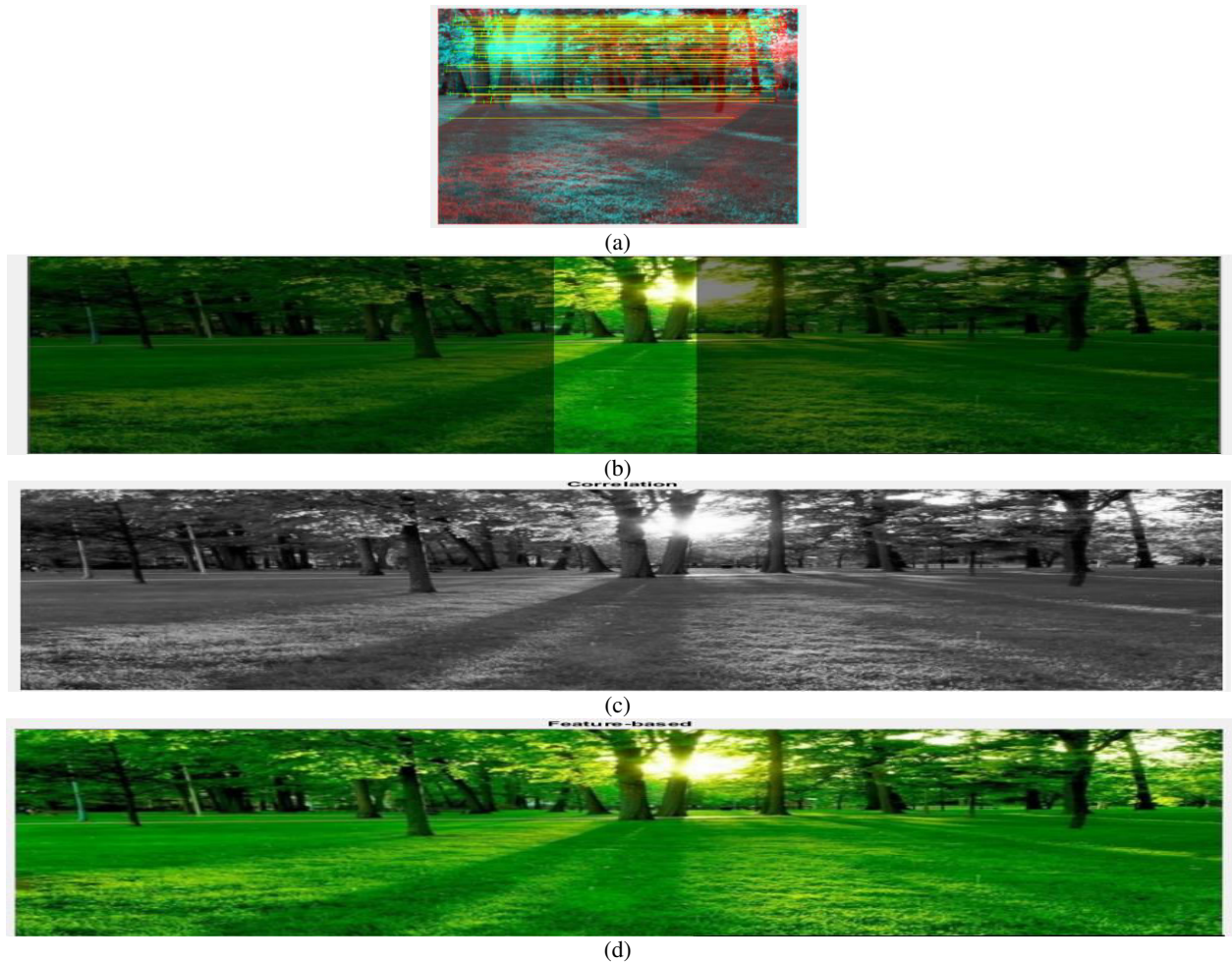


Figure 4. Outputs: (a) Aligned/ registered image on the basis of feature points, (b) Overlapping region, (c) Correlation-based approach, (d) Feature-based approach.



Figure 5. Input images



Figure 6. Output images: Direct Method



Figure 7. Original HDR image (treated as ground truth panorama).



Figure 8. Input images which are generated from the original image of Fig. 7 with some overlapping.



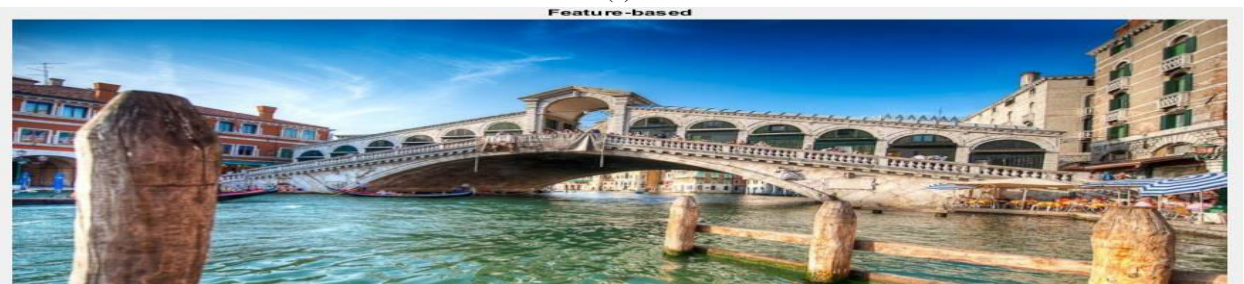
(a)



(b)



(c)



(d)

Figure 9. Outputs: (a) Aligned/ registered image on the basis of feature points, (b) Overlapping region, (c) Correlation-based approach, (d) Feature-based approach.

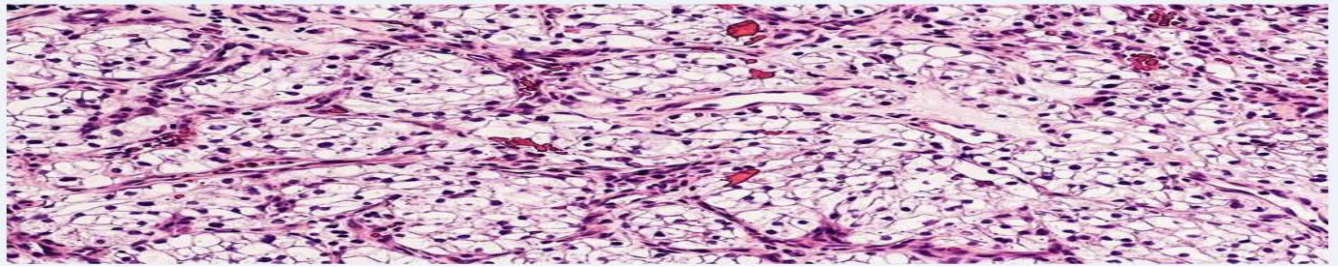


Figure 10. Original microscopy image of renal cell carcinoma (treated as ground truth panorama).

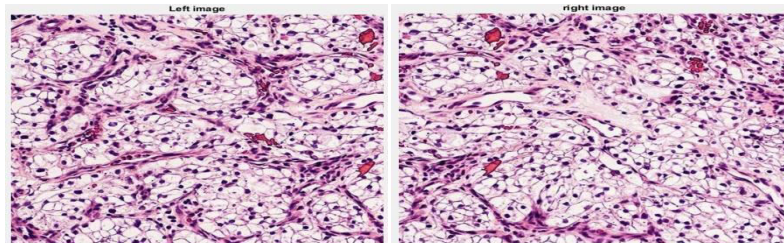
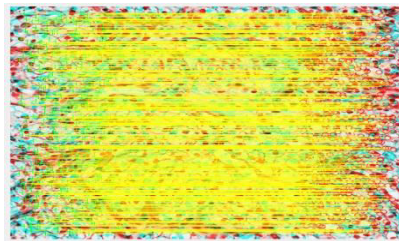
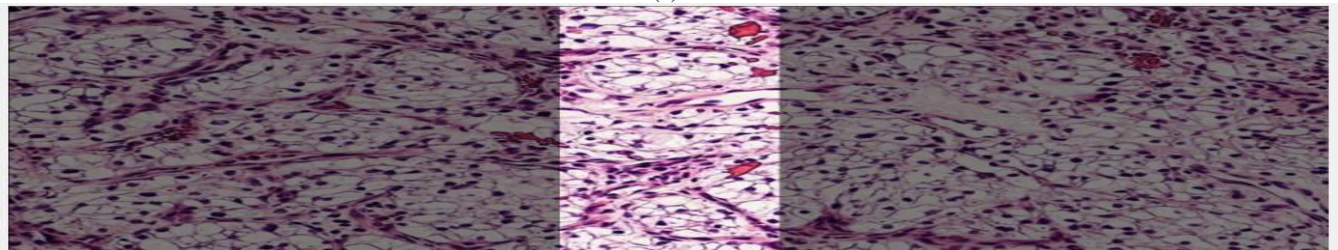


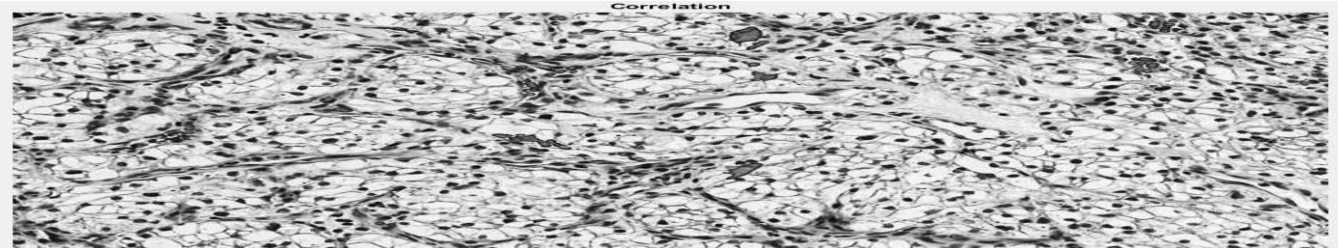
Figure 11. Input images which are generated from the original image of Fig. 10 with some overlapping.



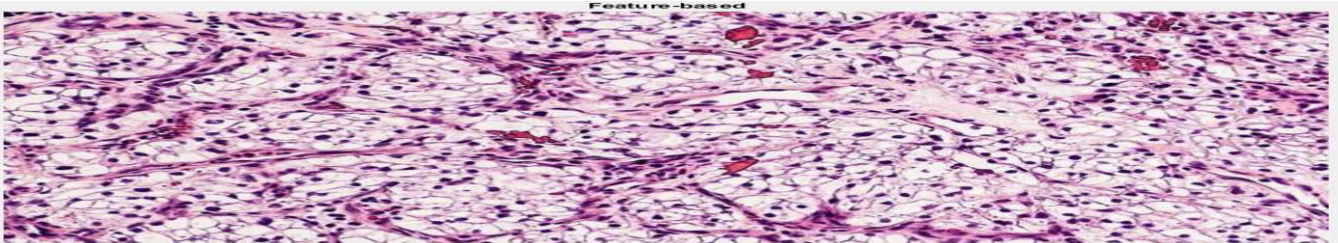
(a)



(b)



(c)



(d)

Figure 12. Outputs: (a) Aligned/ registred image on the basis of feature points,(b)Overlapping region, (c) Correlation- based approach, (d) Feature-based approach

V. APPLICATIONS

Image stitching is mostly used in diverse applications, such as, image stabilization, HDR (High Dynamic Range) image mosaicing, high resolution photo mosaics in digital maps and satellite photos, medical imaging, multiple image super-resolution, video stitching, object insertion, microscopy image stitching and group photographs. In this paper, we have experimented with natural-, HDR- and microscopy-image and got satisfactory results.

VI. CONCLUSION AND FUTURE WORKS

Image stitching is the process of forming a high resolution stitched (panorama) image by combining two or more images together. These input images have some overlapping region with wide field of view to structure a segmented panorama. There are different algorithms for feature detection. Feature-based method uses feature descriptors and correlation-based method uses correlation values to create panorama.

In this paper, we have shown a framework to produce an optimized panorama image on the basis of application needs. We have thoroughly investigated feature-based and correlation-based with accuracy and computation time. Usually, feature-based method needs higher computation time. But correlation method is suitable if the two images are aligned that means registered. Features are very useful for good registration. So, for high quality output in somehow non-aligned environment feature-based method is the optimum choice.

High-quality panorama also depends on light exposure and distortion of lens. So, image calibration can be a supplementary part between acquisition of images and image registration. For good visual feeling we have used alpha blending method that can be replaced by a more robust technique. Another intricacy is photo distortion that arises from the perspective transformation and can be improved by lens distortion correction method.

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A Study On Red Box Data Mining Approach

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Abstract— In the present era, data exploration in business intelligence becomes a big problem. Information plays an important role in the business industry. As data is not classified and segmented in some manner than data exploration becomes very difficult. The theme of this paper is to use RedBox tool that extracts data pattern by using clustering methodology of data mining. It is different from other tools, where data are a combination of alike items and provide a suitable group of each cluster is required. In this method, a number of transaction are getting from the internet by web mining. These transactions are passing from a cluster based data mining algorithm and a significant key is present to identify a priority combination of the cluster through which information extract. This method is used in the business world to improve the business productivity. The major concept of this manuscript is to provide a comparison between data mining techniques and upgrade Red box technique by using web mining. In the future, it will try to improve the Red box approach by using forecasting method.

Keywords—Business Intelligence (BI); Data Mining (DM); Analytic Service Model (ASM); Induction method; Association algorithm;

I. INTRODUCTION

Business is growing rapidly through World Wide Web. There is a collection of data exchange through internet[1]. It enables the big organization to complete their function rapidly and more accurately. All the data is stored in the web documents and pages [2]. Web mining is a technique through which direct extract the important data from web documents and pages. This data is used to better understand marketing dynamics and up to date the organization according to existing trends. Red Box is a new technique that used in business intelligence to make it more efficient. In Red box technique cluster method is used to extract the information. Clustering methodology uses large databases. It is used to collect the data of same type or same attributes from the information. Web mining method is used here to collect the data from web databases.

Business Intelligence (BI) performs an instant action for the organization on the base of the large and dynamic database. The Red box is performing a major role in improving business. It uses the minimum time to take a good decision. In the present era, organizations mostly use Business Intelligence based software. This software makes the business more reliable and economic as they minimize the expenditures, used for promotion of organization products and also minimizes the efforts of employees.

The Red box uses k-means model of cluster method. K-means model finds same priority objects. It is a tree-like structure that organizes data which have the same characteristics. The aim of this paper is to store all the data according to the date. It identifies the date on which organization position was good and bad and also identifies what is the cause behind this. Red box technique used for decision making[3]. Decision making is a tree-like structure in which different factors are involved like store data in their own database which obtain by using web mining, single domains, and different patterns etc.

II. SURVEY ON DATA MINING TOOLS

Red box approach is different from other data mining approaches. It used clustering methodology rather than classification. In classification grouping of data constructed on the base of pre-defined data and in clustering grouping of data is constructed on the base of relationship that exists between data. Data obtained from the web and data-warehouses usually are not present in groups so clustering technique is more suitable than classification. According to Wikipedia classification is supervised learning and clustering is unsupervised learning.

TABLE I. COMPARISON BETWEEN DATA MINING TOOLS

Tool	Techniques	Function	Gaps
SPSS Clementine [4]	Decision trees, Neural Network Bayesian Classification Regression Support Vector Machine	Classification, Estimation, Prediction, Affinity Grouping, Description, Time series data	It is not supported by transactional data
DB-Miner	OLAP and attribute-oriented induction, Statistical Analysis, Progressive Deepening for mining multiple-level Knowledge,	Characterization, Comparison, Association, Classification, Prediction, Clustering	It depends on MS SQL server.
Data Mining Approach [5]	Classification Method, NB, J48, MLP, SVM	Decision making, Classification, Comparison, Data cleaning, Noise Removal, Data scoping	Clustering methodology is missed. It is better than classification.
WEKA [6]	Data pre-processing and visualization, Attribute Selection, Decision tree, K-means, Cobweb, Association rule	Classification, prediction, Comparison, Clustering, Association, Decision trees	It is unable to perform high powered data mining.
XL-Miner [7]	Association rule, Classification, Clustering, Prediction, Time series	Discriminant Analysis Logistic Regression with best subset selection, Classification trees, Naïve Bayes Classifiers, Neural Network	It cannot handle large data set
KNIME [8]	decision trees, Naive B ayes classifiers and support vector machines	Classification, Prediction, comparison, decision making, Estimation	It depends on nodes and does not support programming
STATISTICA Data Miner[9]	random forests, text mining, neural networks, association rules, CHAID, SOFM	boosting and classification trees, feature selections, estimation, prediction, regression	It is not supported by transactional data
KXEN[10]	Association rules, clustering, classification, prediction	Classification, decision making, selection, estimation, regression	It has not good GUI
R Programming[11]	clustering, decision trees, random forest, support vector machine	analysis, classification, estimation, decision making	It does not support customer services support
Insightful Miner[12]	Classification, Association rules, clustering, sequential patterns,	Analysis, prediction, estimation, selection, time series data, Classification	Low GUI
SAS Enterprise Miner[13]	Association, Clustering, DMDB, Graph explorer, decision trees, regression, DM Neural and SVM, Classification	Time series, link analysis, graph explore, decision making, prediction, selection, estimation, Classification	Workflow depends on nodes
Rapid Miner[14]	Machine learning, deep learning, text mining, and predictive analytics, classification by Naive Bayes and KNN	Classification, prediction, analysis, comparison, selection and estimation	Less integration with Data warehouses, and contain a large piece of code
Text Mining[15]	Text mining, Support vector machine	Text extraction, relation extraction, sentence splitting, part of speech tagging, Classification	Used for only text selection and comparison
NLTK[16]	It consists of large interdependent modules	Parsing, analysis, Classification	It has not good GUI
Orange[17]	Orange has multiple components are known as widgets	Analyze data, data validation, comparison and prediction, Classification	It is supported by programming language so, it has not good GUI.
RED BOX[18]	SVM, Clustering Methodology, Decision trees, Association rule, Association Algorithm	Discriminant Analysis Logistic Regression with best subset selection, decision making, comparison, selecting the group, estimation, prediction,	Data does not obtain from the web, classification is not used.

III. INSPIRATION

A. Data representation and storage

Data find and organize in the cluster. Cluster access data and Divide it into parts. All parts are organized in such a way that each part contain same priority and characteristics of data. When it needs to access a group of same priority of data then represent this data that contains certain characteristics.it makes data recovery easy and simple.

B. Business intelligence

It improved business intelligence in such a way that productivity of organization become developed and increase the rank of the organization. It improved skills of business such as data recovery, data management, and data sharing and also manage the cost of data.

C. Cost Controlling

It improved currents trends of the technology of business by minimizing the cost of the product. It managed cost in such a way that offered benefit to the organizations.

D. Data Collection Method

Data access from different sources like from their own database, from web mining, data warehouses, and different website. It makes easy to analysis and gets the relevant data from all of these sources.

E. Marketing

It improves market share by examining data model. Such as what is the structure of the model and how it is work? Which basic components that are used for business intelligence? It also examines how these components used for data analysis to improve market share without any interference.

F. True Decision

It helps in true decision making. It forces on module learning. Module learning develops a good decision making that is really needed for the improvement of business intelligence. Such as to understand a complicated problem of programming then must be read it thoroughly. If this problem exists already in an organized module then it is easy to understand and bring a solution for it.

IV. METHODS USED IN RED BOX

The techniques of data mining are developed to work on existing information inside the Analytic Service Model (ASM). ASM is designed in such a way that it analyzes all type of information. It is customer oriented. All kinds of data first pass from Analytic Services Model and then find the sections of these data by using mining tools to get input for the algorithm of data mining framework and obtain the output based on the input . The data mining framework may use only for constantly dimension members. Only the specific data is applied to it which used constantly dimension members (not used attribute dimensions or user specific dimensions). It is represented as

input data to the Data Mining Framework. Thus, data which is required for analysis must present in standard dimensions and evaluate it inside the cube. Now, examine what the items a customer buys from the market and find characteristics of these items to identify why these items bought with other items.

Data mining tools such as prediction, classification, affinity analysis, reduction, exploration, and visualization these all are used for data analysis and identify their characteristics to make clusters[19]. The database is introduced to maintain the data in a systematic way. Data present in the database are organized in the form of a table. The table is a collection of rows and tables. Business Intelligence is a method used to access these data.

Data mining is an advanced technique which is required to get only mandatory data from their data warehouses and web mining. Data mining improves Business Intelligence by good decision-making method[20].

This paper presents a detailed study on Red box tool and comparison between other data mining tools which used in the business intelligence model. Red Box approach contain methods i.e. web mining, clustering, association rule, decision trees and association algorithm

A. Web mining

Web mining[1, 2] is a data mining technique which is used to mine important data pattern from the web. These data patterns represent behavior and interest of the user. It also navigates which data pattern is popular among users. It identifies the relationship between items of data which improve the structure of strategy. This structure helps the owner to make a better decision. Web mining improves business intelligence. It mines important information from the web, uses this information as an input, stored in the database and also gets the output corresponding with input as for required. The major drawback of RedBox is that data cannot directly accessible from the web. This problem is overcome by using web mining.

B. Clustering Methodology

It is the main technology of data mining. It gathers items in a group and makes a cluster but it is different from classification as it is not used for a predefined group of data. Whether it is beneficial for data extraction. It finds the clusters which data make itself. For example, in a supermarket cluster is made by those items that customers purchase mostly and buy items relatively with other items or maybe another way. For example, assume the sale transactions of a customer superstore. Its grouped clients by sale date contained different cluster emerge: clients who purchase vegetable and oil frequently, clients who purchase meet every time, who buy baby food, milk etc.[18] .

C. Decision trees

Decision trees[18, 21] work as a flowchart . These trees especially useful for decision making. These decisions create rules for constructing groups of data. Decision trees help to generate an optimized path for a better decision by understanding a minimum number of steps. For example, Classification and Regression Trees (CART). CART give directions for the new dataset to evaluate which group of data will have an appropriate outcome. Decision trees also help new user to find his particular target on the web.

Decision trees are great for decision making as they construct a group of customers and products on the base of priority and having same attributes which permit analysis of all kind of dataset. The classification method is applied to calculate persons, objects, transactions or events by dividing them into groups. For example, if a supermarket owner wants to divide their customers into three groups. 1) Higher class 2) Middle Class 3) Lower class. He has stored data about customers characteristics and their buying data pattern and then by using classification model he is enabled to divide them into above three categories [22].

D. Association rule

Rule Induction[21] is a derivation of important if-then rules from datasets depends on statistical significance. It explains the statistical correlation among the existences of items in a dataset. Association rule mining is an important type of data mining which uses the rule induction technique. It is used to derive data and identifies the relationship between different items of the dataset. It helps in identifying the purchasing attitude and trends of the customers.

E. Association algorithm

Association Algorithm is used for the referenced engine which depends on analysis of product and market. This helps the customers in selecting the items on the based they purchased earlier. The model is constructed by a database that has identifiers. Each individual as well as a collection of items that contain cases both having identifiers. This collection of items in a database are called item set. These algorithms navigate the data to find the objects which present in a case. MINIMUM-SUPPORT [18] is used for all items which may exist in the case. Market analysis is also called associative analysis. Popular items that commonly used together is analyzed by using associative analysis. For example, in a supermarket cluster is made by those items that customers mostly purchase relatively with other items. Such as supermarket owner is not surprised to know if a customer purchase milk, tea, sugar, bread, and jam together.

Associative algorithms help the customer to find the group of items that relatively connect with each other. They also help the owner to place the relative items in the right place. Above described the Data mining techniques like web mining, a clustering method, decision trees, and rule induction and association algorithm [22]. The aim to describe above all methods is that to cover all aspects of Red box approach which may affect the trends and behaviors of Business intelligence.

V. USES OF RED BOX

The red box makes the structure of database user-friendly. It also maintains a data structure of stored databases. Association rule mining is the second application of Red box in which it examines and evaluates database. Each transaction comprises data of client's transactions. These data is consist of different items. Rule mining identifies the relationships among these different items. It is collecting the same priority of items in a group which contain support & confidence values that equal or more than equal values of user-defined support and confidence.

These user-defined minimum confidence and minimum support are both of two operations which measure the interestingness of association rule mining. These rules are called interesting association rule. These rules denote a collection of different items. Such as an organization wants to improve its market strategy.[22] It collects information about products which are very popular in the market. This information is got by interesting rule. But this organization also gain information by non-interesting rule such as that product that is unpopular in the market. Because it is also a good information collecting by organization owner to increase its profit.

The main concept of the Red box is to derive meaningful information from the existing database by using data mining algorithm where each transaction recognizes the Business Intelligence. This existing database is gathered from web mining, data warehouses, and business transactions etc.

VI. CONCLUSIONS AND FUTURE WORK

This paper defines Redbox technique, clustering methodology, Web mining and also explore data mining tools to describe how to make cluster by using clustering technology. It explores how to recognize the data patterns of a data set or between the collection of items. The application Redbox approach improves the Business intelligence. It highlights the current business trends which help the user to take a better decision that increase the profit of the business. This is suitable for the situation in which a customer needs specific items from the collection of items. This helps the customer in predicting the items that exactly they want on the basis of previous purchasing items. This is best for the same data structure of the database that performs multiple tasks of business.

In the future, forecasting technique[23] of data mining will be used in acquiring the more accurate data. When the possibility of predicting the data will be increased then algorithm of forecasting method will be used to suggest a more accurate item.

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A New Architecture for Multiparty Web Real-Time Conferencing Systems

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Abstract – Conferencing systems have been usually deployed using proprietary softwares. Alternatively, the growing interest in integrating interactive multimedia features into web applications has recently led to the creation of the WebRTC (Web Real-Time Communication) open standard. Accordingly, the use of specific software for Real-Time Communication is no longer needed on the web. This work is concerned with the formal specification and the validation of Multiparty WebRTC conferencing systems. This is in order to make contributions to solve technical challenges of the standard in the context of a distributed control and signaling protocol, manipulating complex data structures, changing topology, i.e. nodes that join and leave the network. Particularly, we expose a novel architecture for WebRTC multiparty conferencing systems, and then we present an SDL (Specification and description language) formal model of the proposed architecture. Finally, we present a validation of our model.

Keywords - WebRTC, Multiparty Videoconferencing Systems, Signaling, Specification and Description Language (SDL), Message Sequence Chart (MSC), Model Validation.

1. INTRODUCTION

Nowadays, the Web is becoming more and more the platform of choice for all communication. Progressively, People switch from solutions provided by their telecommunications company (telephony and text messaging), to Internet-based services. In this context, WebRTC (Web Real-Time Communication) [1] an ongoing standardization effort, appears to enhance user experience in RTC (Real-Time Communication) via the Web. WebRTC support is included in almost all modern browsers, so users can participate in media sessions without any additional installation. Accordingly, WebRTC technologies are an opportunity for defeating the overcoming fragmentation between WWW (World Wide Web), desktop and mobile multimedia Real-Time Communications services and realize a convergence.

Furthermore, among the most important applications of WebRTC are the multiparty conferencing systems. Indeed, multiparty video conferencing has many important use cases like team meeting for a group of colleagues or a public interactive event with one speaker and hundreds of viewers. And it can have an impact on many sectors like education, health, industry... From the technical point of view, the videoconference system is composed of four planes: Media delivery plane, Signaling plane, Control plane and Floor Control plane see Figure 1.

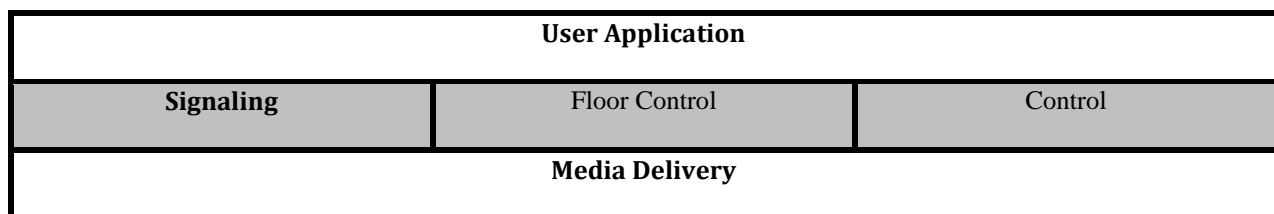


Figure 1. A general view of videoconference planes.

First, media delivery plane permits to forward the media, to mix it and possibly to transcode streams between WebRTC clients participating in interactive sessions. Second, signaling plane allows the participation in sessions and the negotiation of multimedia configuration. Third, the control plane reorganizes the connection topology in the conference according to the joining and leaving of clients. Finally, floor control plane is set to manage exclusive or joint access to shared resources in a session. In the literature, the boundary between signaling and conference control

planes is ambiguous. For instance, the conference membership management can be seen as a part of either signaling [2], or conference control plane, [3]. In this work, we consider it as part of signaling plane.

Therefore, the subjects that will be covered in this paper are signaling and control aspects by tackling their related problems such as NAT (Network address translation) and firewall traversal issues and network topologies in the context of multiparty multimedia conferencing systems. Actually, for more than browser-to-browser connection, deploying multimedia communication based on WebRTC API is not inherently supported and requires direct P2P negotiation between participants as well as signaling interaction with a server to orchestrate the communication among all involved clients, [4].

Moreover, the Internet addressing system is still using IPv4 (Internet Protocol version 4) and because of that, most of our devices are behind one or more layers of NAT. NAT is a mechanism that allows devices located on a private network to transparently communicate with devices located on an external network, such as the internet. It does so by modifying packets traveling between networks, replacing the private source and destination IP addresses and ports with public ones where necessary, while maintaining an internal lookup table of these mappings.

Besides, routers usually activate security mechanisms such as firewalls. In fact, in some restrictive environments it might be impossible to succeed with the call establishment. So, this affects the reliability of WebRTC.

To deal with those challenges, solution providers use ICE (Interactive Connectivity Establishment), [5]. ICE is a mechanism that tries to find the best path to connect two peers. The enablers that work together with ICE for Real Time protocols are STUN (Simple Transversal Utilities for NAT) [6] and TURN (Traversal Using Relays around NAT), [7]. ICE uses a STUN server to discover the available IP addresses and ports that allow direct connectivity to a peer placed behind a firewall or NAT. Those interfaces are named candidates. If that fails, the traffic is routed via a TURN server. TURN server is a STUN server with added relaying functionality. The TURN option according to ICE algorithm is always stated as the last resort when connection to no other candidate was established.

In addition to those connection establishment problems, new challenges in terms of distribution topology and conferencing membership are created in the context of multiparty. In the literature, the two most common network topologies are the mesh network and the centralized or star network. In the full mesh topology, every peer establishes a connection with every other peer in the network. Star network architecture could be realized by one of three options: Firstly by relying on the most capable device as the hub of the network. Secondly, this conference bridge can be a single server or finally the requests handling could be on different physical machines that realize a load balancing in a server cluster, this is named Stand-alone topology. All of the described topologies have the property that they consider peers as having equal capabilities in contrast to overlay or supernode topologies, [8].

In the latter type of topologies, and in order to select a supernode, there are different selection mechanisms that can be used. The schemes can be classified into four distinct groups, [9]. The first group, the simplest one performs the supernode selection manually or by a central entity. The second type is a type of distributed decision, where a node population is broken down into smaller subsets depending on varying conditions such as location, network proximity or others. These subgroups then elect one or multiple supernodes independently. This approach is used in an algorithm, called Pop-Corn which was used in the context of WebRTC in [8]. DHT (Distributed hash tables) are also used by nodes to discover which nodes are close to them in a DHT defined space to gather into groups and then select internal supernodes. The fourth method is the adaptive algorithm based supernode selection. As its name suggests, the rules of selection are adapted by designers to fit the needs of their solution. The criteria can be the supernode capacity or the expected session time. To sum up, related works on the topic of Web Real-Time Conferencing systems as it is explained in the next section is either a formal validation or a simulation of models or a proof of concept or frameworks demonstration of implementations.

The remainder of this paper is organized as follows. In section 2, we present a survey on recent work on the problematic. Section 3 gives an overview of Multiparty Web Real-Time Conferencing systems that is subject to our formal work. In the same section, we discuss the reasons why we choose SDL and MSC to model the system and we describe the SDL model of WebRTC Multiparty system. Finally, we introduce the work on the Validation of the model in section 4 before giving conclusions and future perspectives to our work.

2. RELATED WORK

There are a lot of publications dealing with multiparty video conferencing systems in the context of WebRTC but they are mostly concrete implementations discussing the topology problem. Other works study the impact of bandwidth limitations and video resolution size on QoS (Quality of service) and on QoE (Quality of experience) for WebRTC-based mobile multiparty video conferencing systems, [10]. In the literature, we found few works close to our approach using formal techniques for modeling the network protocols related to WebRTC. A recent publication

[11] uses finite state machines in order to collect and analyze the WebRTC flow. In [12], we present a formal approach for modeling the signaling exchange between two WebRTC communicating entities and in [13] we validate the resulting model using the Reachability Analysis techniques, to show that the system is free of design errors.

Nevertheless, no publication was found leading a formal modeling and validation of Multiparty Web Real-Time Conferencing systems. In table I, we discuss some advantages and limitations of chosen architectures in different planes based on chosen papers addressing WebRTC multiparty conference issue.

TABLE I
WORKS IN WEBRTC MULTIPARTY CONFERENCE TOPOLOGIES ADVANTAGES AND LIMITATIONS

Ref	Deliverables	Chosen architecture	Advantages	Limitations
[14]	Overlay architecture proposal	<p>Media plane: clustered organization of WebRTC clients interconnected through a reflector mesh. Clusters division made based on the geographical location of clients. Reflectors are connected in a full-mesh topology, and are with mixing features.</p> <p>Signaling plane: Centralized in a rendezvous point (SIP handshake process).</p> <p>Control plane: Centralized in a rendezvous point (RP) with permanent TCP connections with all the reflectors.</p> <p>Floor Control plane: Centralized in a Binary Floor Control Protocol (BFCP) server.</p>	<ul style="list-style-type: none"> - Data plane topology minimizes end-to-end latency (a maximum of two reflector hops to traverse) - Mixing approach saves bandwidth. - Floor control plane ensures the number of streams to mix is low. - Interoperability with most SIP applications and voice over IP phones. 	<ul style="list-style-type: none"> - Chrome and Firefox include incompatible multi-stream capabilities in their WebRTC implementations.
[8]	Javascript library Demonstration	<p>Media plane: Overlay topology - Group based supernode selection algorithms with the location as criteria. Goal: Reduce communication latency.</p> <p>Signaling plane: Centralized in a server with WebSocket as signaling channel.</p> <p>Control plane: Centralized in a server. All mutation information about topology is sent to the server. After, Supernodes update periodically its list from the server. Every node has a connection to at least three supernodes. Full mesh topology between supernodes.</p> <p>Floor Control plane: Undefined.</p>	<ul style="list-style-type: none"> - Minimizing server use and avoid maintaining expensive Servers. - Scalability. - Decentralized approach to supernode selection. - Fast communication in the network. - Backups for supernodes. 	<ul style="list-style-type: none"> - Full mesh topology between supernodes. - Routing tables and supernode selection scheme need more optimization. - Interoperability issue.
[4]	Two implementations using supernodes.	<p>Media plane: Supernode Topology.</p> <p>Signaling plane: Centralized technology: socket.io</p> <p>Control plane: Centralized.</p> <p>Floor Control plane: Undefined.</p>	<ul style="list-style-type: none"> - Alleviation of the load on nodes as well as not adding any load on the backend. - Better service quality (Bandwidth usage, video conference set up time - Video resolution). 	Perceived latency
[15]	API design implemented in NODEHALA project tested successfully with 25 concurrent connections.	<p>Media plane: Single-server topology Multipoint Control Unit (MCU).</p> <p>Signaling plane: centralized Service Manager.</p> <p>Control plane: Centralized API.</p> <p>Floor Control plane: Undefined.</p>	<ul style="list-style-type: none"> - The system with additional cost, has the ability to scale up*. - Light endpoints. * To scale up means to add more resource: adding more CPU or memory power to the single machine. 	<ul style="list-style-type: none"> - Backend load. - Higher Cost.
[16]	Implementation of MCU Prototype	<p>Media plane: Single-server topology "Centralized MCU".</p> <p>Signaling plane: Centralized in a Web server.</p> <p>Control plane: Centralized.</p> <p>Floor Control plane: Undefined.</p>	<ul style="list-style-type: none"> - The feature of media recording stream processing, and composition for screen adaptation exists. 	<ul style="list-style-type: none"> - Backend load. - Interoperability issues: between different type of devices and need for gateways to other video conferencing solutions as XMPP and SIP.
[17]	Implementation and test of a proposed	<p>Media plane & Signaling plane &</p>	<ul style="list-style-type: none"> - Flexibility and scalability - High deployment granularity 	<ul style="list-style-type: none"> - Same architecture for 3 planes creates dependence

	architecture in a Cloud Computing environment	Control plane & : Distributed software MCU Architecture to be deployed independently on demand in a Cloud Computing environment. The software solution can be virtualized to be deployed according to controlled scenarios. Floor Control plane: Undefined.	for conferencing infrastructures.	because MCU acts at 3 different levels: Signaling, Media (Pure forwarding MCU), Control (Concept of rooms). - A considerable amount of added management messages and components that could affect the performance of the communications: - Delay in the connection establishment time.
[3]	Pure Javascript application	Media plane & Floor Control plane: Undefined. Signaling plane & Control plane: P2P structure using DHT protocols, the server involved just for newly joining peers (Some connection establishment). Peers Coordinate through RTCdatachannels.	- Scalability - Server burden and high rate signaling behaviour avoided	DHT protocols are heavy and cannot operate in real time so it's more suitable to use cases such as file sharing within Web browsers.
[18]	Implementation of a web browser compatible framework	Media plane & Floor Control plane: Undefined. Signaling plane & Control plane: A framework that uses a modified version of Chord to make the signaling server weakly involved. Handshakes are made between the new peer and the network via the boot peer using the Data channel component of WebRTC.	- A modified version of Chord used which runs in predictable time and always results in success or definitive failure. - More decentralization and scalability. - Single point of failure avoided.	- Compatibility issues between browsers. - Messages may be delivered out of order because of network dynamicity and this can cause errors.
[19]	Implementation of a signaling mechanism named (WebNSM)	Media plane & Floor Control plane: Undefined. Signaling plane & Control plane: a combination of different topologies, such as simplex, star and mesh. (An hybrid system)	- Two mechanisms for video conferencing are offered. - Freedom to choose the appropriate mechanism based on the available bandwidth and CPU capabilities. - Flexibility for the user to change its position from broadcaster to the viewer and conversely.	- The number of peers limited by the CPU. - Bandwidth does a leading role in the quality of audio and video. - Mesh topology requests a high CPU and high bandwidth speed.

After this quick survey of the state of the art, we introduce in the next section an overview of Multiparty Web Real-Time conferencing systems that will be subject to our formal work. After that, we discuss the reasons why we choose SDL and MSC to model the system. Besides, the formal SDL model is described.

3. MULTIPARTY CONFERENCING SDL MODEL DESCRIPTION

Before describing the proposed system in SDL formalism, we first explain the expected behaviour from the new Multiparty Web Real-Time Conferencing systems in natural language.

A. Overview of Multiparty Web Real-Time Conferencing Systems

The proposed system is composed of the participating browsers, and of some essential servers to the NAT and firewall traversal utilities like STUN and TURN servers. Although, WebRTC based browsers can communicate directly within a conference using the 'PeerConnection' function, it will necessarily include a Web server that supports conference required procedures like room creation/destruction, and participant joining/leaving or even removal, [20].

First of all, there must always be a room initiator to open the room. A joining participant is free to select the option to be a "Listener" to watch and listen to the broadcasters or select to be a "Broadcaster" to set up bi-directional video conferencing session. In the proposed configuration, the conference has one initiator and different peers as listeners or broadcasters. The whole system must be able to provide scenarios as follows:

1) Adding a user to the conference:

WebRTC doesn't supply any mechanism to register and identify browsers. In this paper, we assume that the joining member should initiate the call by sending a joining request. This is what we call the *dial-in* mode. The Web server considers creating an instance of the peer before sending a notification to the initiator that a participant has asked for availability. If the joining peer is a listener, the session established between the initiator and the listener is a unidirectional video conference. In contrast, if the new peer is a broadcaster, this configuration enables him to establish bi-directional video conferencing with the initiator and with all other broadcasters and unidirectional video conferencing with listeners, see Figure 2. This results in a mesh topology between Broadcasters, and centralized topology between broadcasters and listeners.

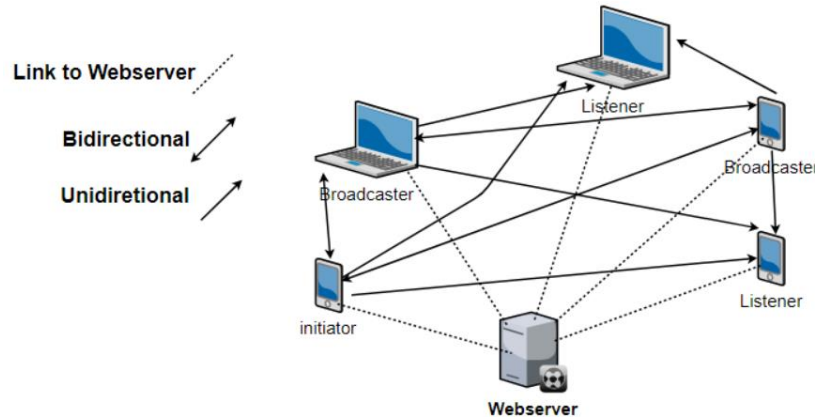


Figure 2. The Multiparty Web Real-Time Conferencing Architecture.

To sum up, the topology proposed in this paper can be considered as a hybrid one that uses different topologies and gives the users flexibility to choose to communicate as initiator, broadcaster or listener.

2) Handling member departure:

A peer can at any time leave the conference, by sending a close message to the Web Server. If the peer is a listener the Web server will simply accept his departure. However, initiator or broadcaster departure is less obvious to support than listener since listener's departure doesn't affect media distribution. In this case, the Web Server will ask the peer to close the session with all listeners and remove the media streams before accepting its departure. We are working on a more reliable mechanism of departure to handle critic situations where a peer leaves the conference without notification because of a network problem for example.

B. Language Adopted

It is found experimentally, that for certain types of tasks and problems of development, diagrams are more explicit and efficient than natural language. Therefore, the visual specification is a descriptive approach that aims primarily to visualize interactions clearly.

In addition of being more understandable, meaningful and easier to share, once a consensus on the semantics of the diagram has been reached, visual notations can be defined as languages with strict rules of syntax, semantics and symbolic manipulation which represent formal entities. The utility of these types of formal visual notations is to perform a validation work on a visual model, and to ensure automatically that certain types of faults are excluded. This work is similar to that made on purely textual specifications, without the complexity of hard formal expressions. All those described benefits can be found in SDL and MSCs (Message Sequence Chart) formal approaches.

SDL is an expressive specification language, containing many syntactic constructions. It was designed to specify clearly and compactly a wide variety of protocols, and more generally of asynchronous systems. One important feature of SDL model is the possibility of generating simulations as a partial validation technique. Indeed, this method increases trust in the program correction if no error is detected. Several tools supporting SDL exist. We choose to use IBM's Ration TAU as it offers many validation possibilities. Indeed, to make sure that the program meets its specifications, the tool Rational TAU¹ can realize full Validation based on an SDL model. Furthermore, MSCs can be used to characterize user interaction scenarios and used these scenarios to validate the SDL model. The usage of those technics is illustrated in section 4 of this work.

¹ <http://www-01.ibm.com/support/docview.wss?uid=swg24023175>

In the following subsections, we describe the SDL Model that represents the interaction between different entities involved in the WebRTC Multiparty conference. First the architecture design is explained; second the behaviour reflecting the initialization and the communication between Blocks is illustrated by some excerpts from process diagrams. And last the data structures and SDL signals that represent protocol messages or service primitives are introduced.

C. Architectural Design for the Multiparty Conferencing Model

In the structural part of formal modeling, the system in the highest level of abstraction is considered as a black box stimulated by and probably sending back signals from the environment. After, in a Top-Down approach, the system is decomposed into blocks that are subdivided into other blocks or processes.

The architectural design is presented firstly by the system view and secondly by two blocks views. Actually, the Multiparty WebRTC system is composed of two blocks, namely, 'Servers', 'Peers' communicating with each other by channel 'C3' and with the environment by channel 'FromEnv' and 'C2' respectively, see Figure 3. To ensure modularity and reusability of components, we use two packages: 'WebRTCEntities' regrouping process types and 'WebRTCMessages' defining signals and data structures needed in the whole model.

Three processes 'StunServer', 'TurnServer' and 'WebServer' represent the block 'Servers' and receive the signallist (B2SrvMsgs) from the browser. 'StunServer' shown in the top of Figure 4 gets 'STUNReq' as an input signal and responds by 'STUNSuccessResp' to enable browsers to learn about the presence of a NAT, and to discover the public address that the NAT has allocated for the UDP (User Datagram Protocol) flows to remote Browsers. Additionally, 'AllocateReq' is sent to 'TURNServer', which can respond either by 'AllocateSuccessResp' if it can provide a relay address for Media traffic or by 'ErrorResp' if not.

The WebServer is the first process to learn about a browser who wants to join a conference by the message 'NewParticipant'. Then, it communicates with block 'Peers' by sending the message 'CreatePeer'. The behaviour of 'WebServer' process is detailed in the subsection D.

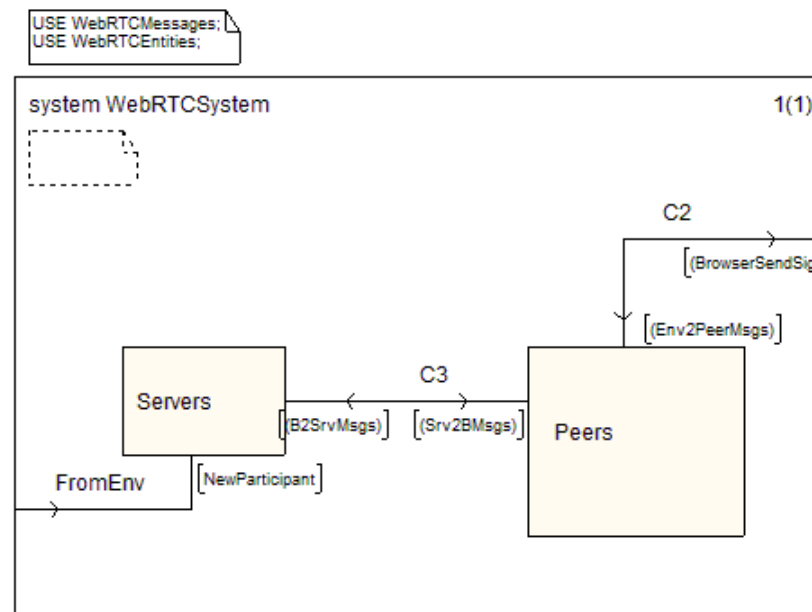


Figure 3. A system view of the Multiparty Conferencing Model.

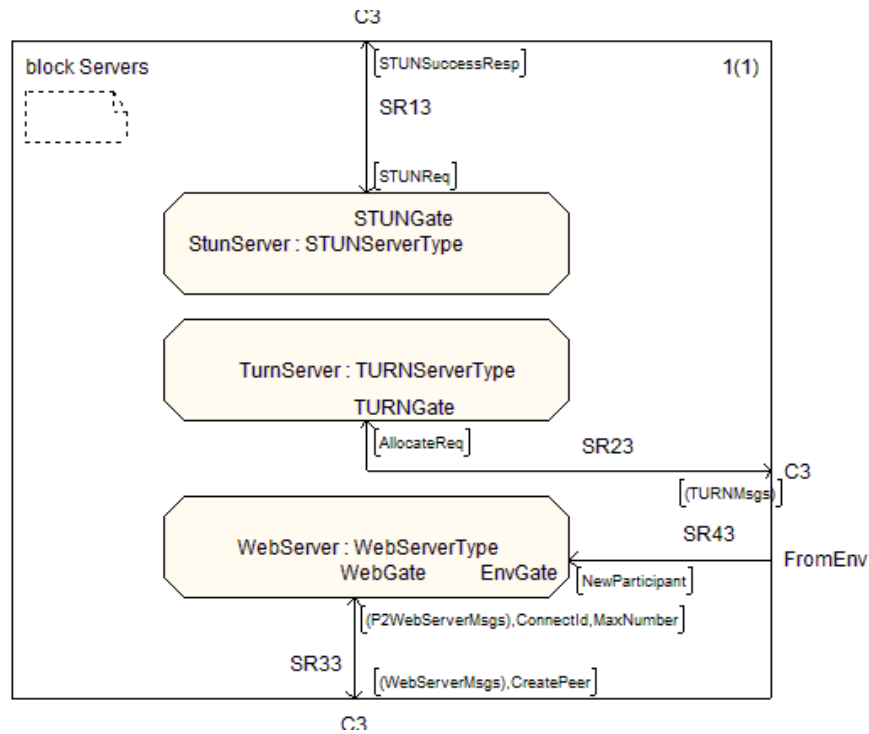


Figure 4. Block Servers view.

The Block 'Peers' is organized into three collaborating processes that are depicted in Figure 5. First, 'PeerConstructor' process is responsible of the dynamic creation of all instances of 'WebRTCpeer' at runtime. This is indicated in the diagram by a dashed line from the creating process to the created process. Second, the process 'WebRTCpeer' represents in the model the behaviour type of all participating browsers in the conference session. The name of 'WebRTCpeer' is followed by the initial number of instances and the maximum number of instances, here 1 and 10 respectively. Finally, 'RelayChannel' process was not included in the first configuration of the block 'Peers' shown in Figure 6.

In this figure, we create the channel 'SR1' that carries the signal list 'PeerSelfMsgs' to represent messages exchanged between the different instances of 'WebRTCpeer' processes. However, this configuration generates in the Analyzing step an error that recommend that the endpoints of the path 'SR1' must be different. Indeed, in Rational TAU, unlike other specification and description tools didn't permit a channel or signal route to connect a block nor a process with itself.

To solve this problem, we proposed to add another process in the 'Peers' block that plays the role of channel 'SR1'. The behaviour of this process can be compared to the principle of the HUB, i.e. when it receives a signal from an instance of 'WebRTCpeer', it retransmits it to the same instance or another instance of 'WebRTCpeer', according to the context, without making any changes on the signal. In the next subsection, the behaviour of the previously described processes is detailed.

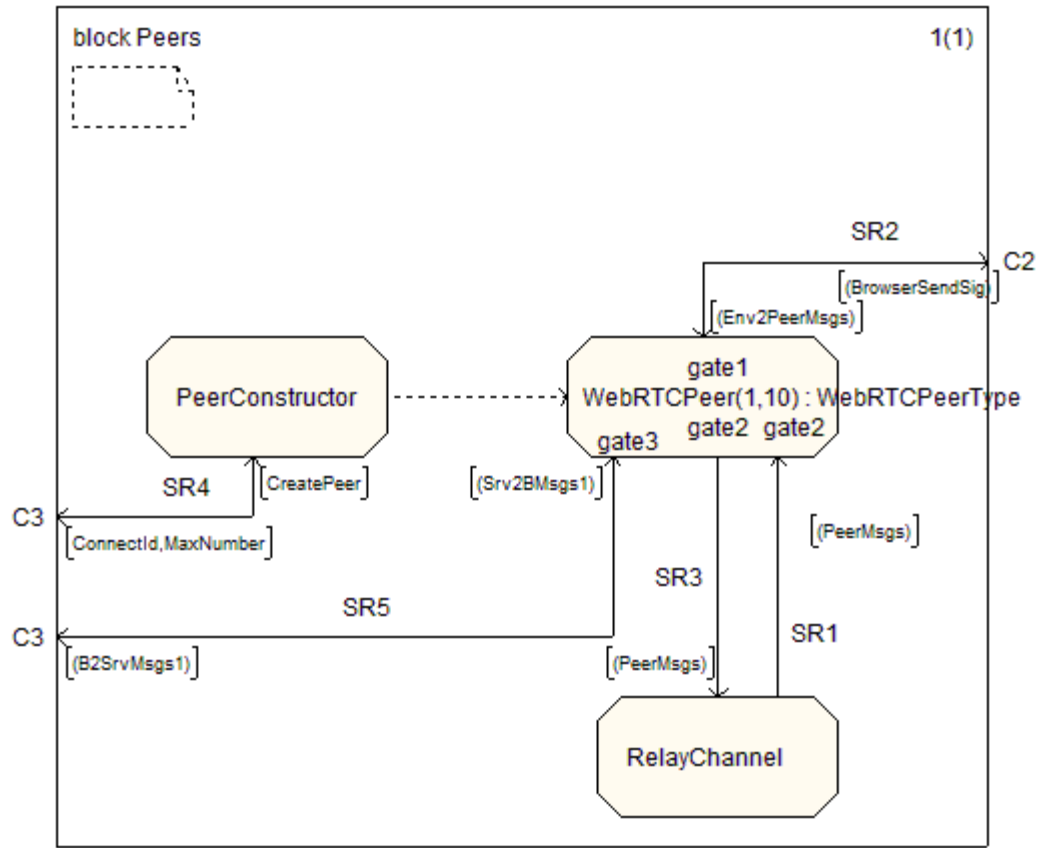


Figure 5. Block Peers view.

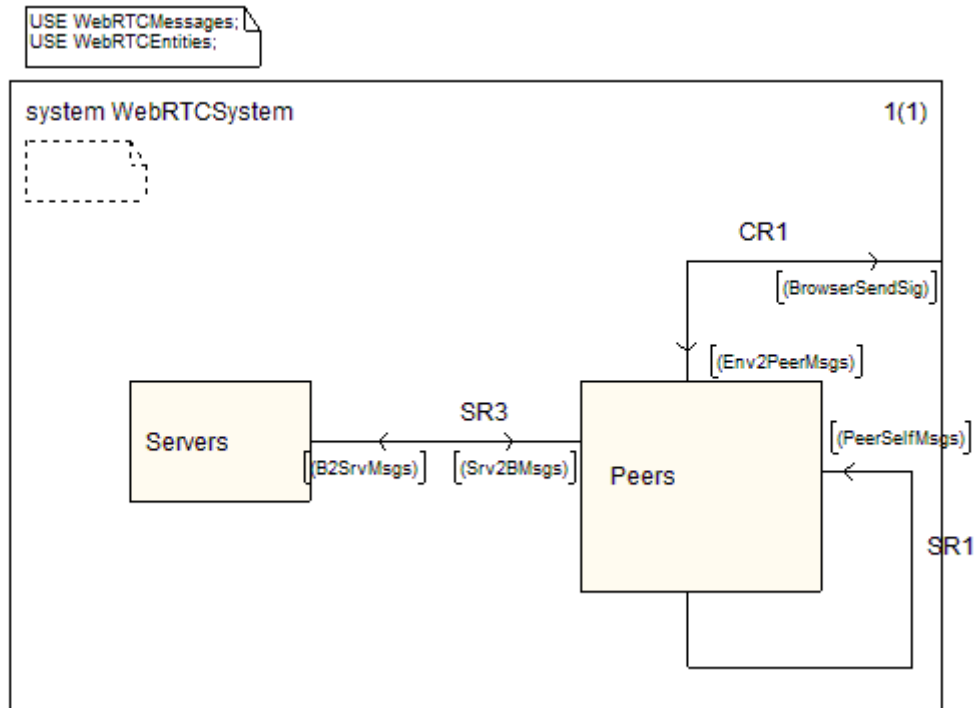


Figure 6. System view before modification.

D. Behavioral Design for the Multiparty Conferencing Model

A process is a finite state machine (FSM). It has an implicit message queue to receive messages. Each SDL process is formed of numerous states. A state determines which task the process will execute when receiving a specific stimulation. A transition is a code between two states. It is possible to have several instances of the same process running independently.

The process 'WebServer' plays three important roles in the model: it triggers the creation of a new WebRTC peer instance (Figure 7), after it interacts with this new instance by opening a new room if it doesn't exist for a given URL or by adding a new member to an existing room (Figure 8). Finally, it manages the peer's termination of a session (Figure 9).

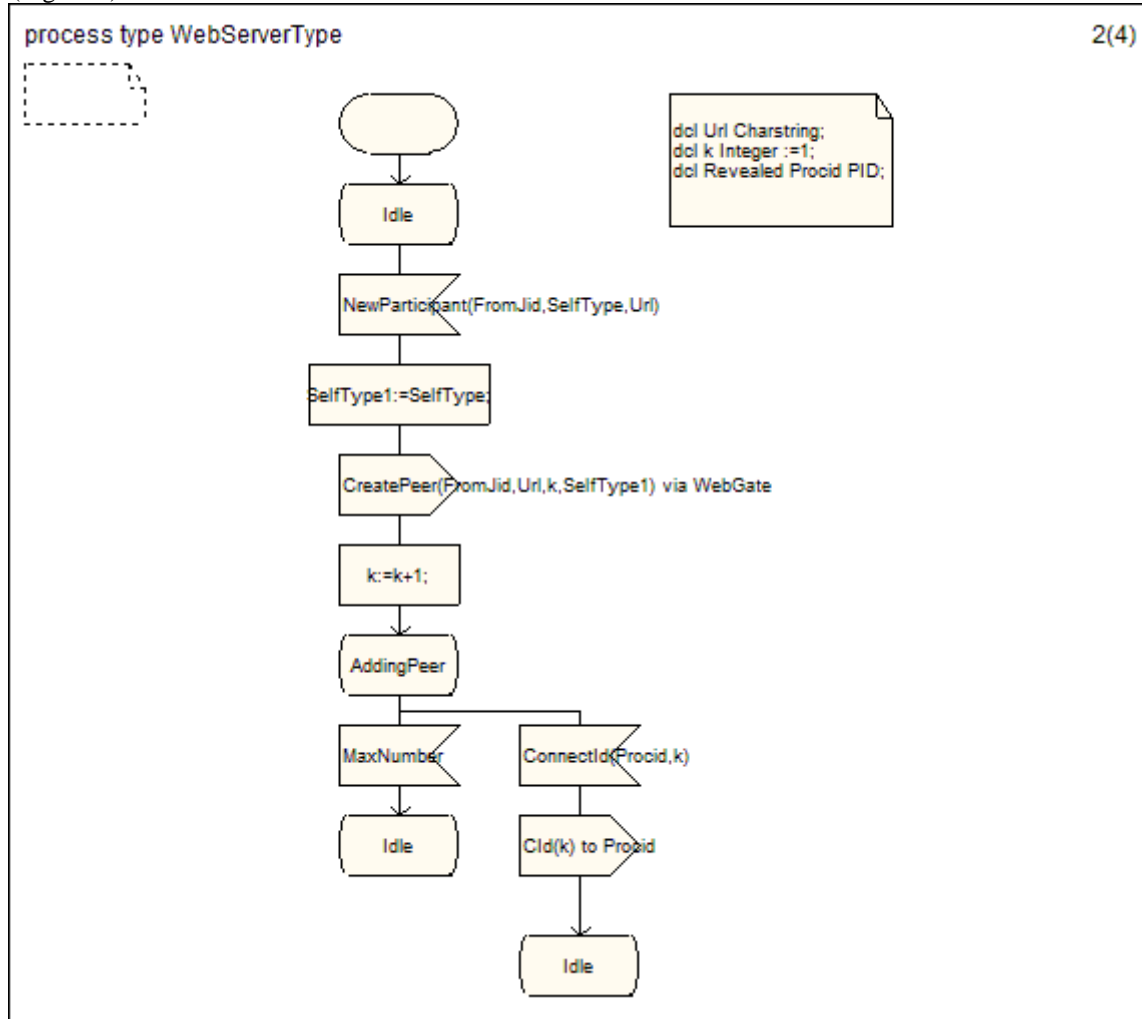


Figure 7. WebServerType Behavioral Diagram Extracts – a

The peers that want to join the same conference connect to the 'WebServer' via the same URL. And by the signal 'NewParticipant' the peer specifies its address 'FromJid' and its type 'SelfType'. Those two variables are new defined abstract data types, (see Figure 11). Indeed, to model the address of a Jingle calling browser like: asma@inpt.ac/office, we use a structure named 'Jid' of four elements: An integer 'IdBrowser' and three charstring (User, Domain, and Resource). The second abstract data type is an 'Enumeration' named 'PeerType' taking one of three literals (Initiator, Listener or Broadcaster).

After that, the 'Webserver' sends a signal 'CreatPeer' to the process 'PeerConstructor' and goes to the state 'AddingPeer'. If it's possible to create a new peer, the Webserver receives 'ConnectId', and the response is 'Cid' with an integer that will be an index of array peer or member. However, if the maximum Number of peers is reached the input signal is 'MaxNumber' and the creation failed.

Considering the informal specification described earlier, the Webserver process can either be asked to open a new room or receive a demand from a new joining peer to detect the existence or not of the desired room. The 'Idle'

state can therefore receive two types of messages: 'OpenRoom' and 'DetectRoom'. The sender id is stored in the 'InitiatorPid' or 'PeerPid' variable respectively to help determine the receiver of the next output signals. We used the boolean variable 'Roomexists' to enable taking the decision and execute the convenient actions.

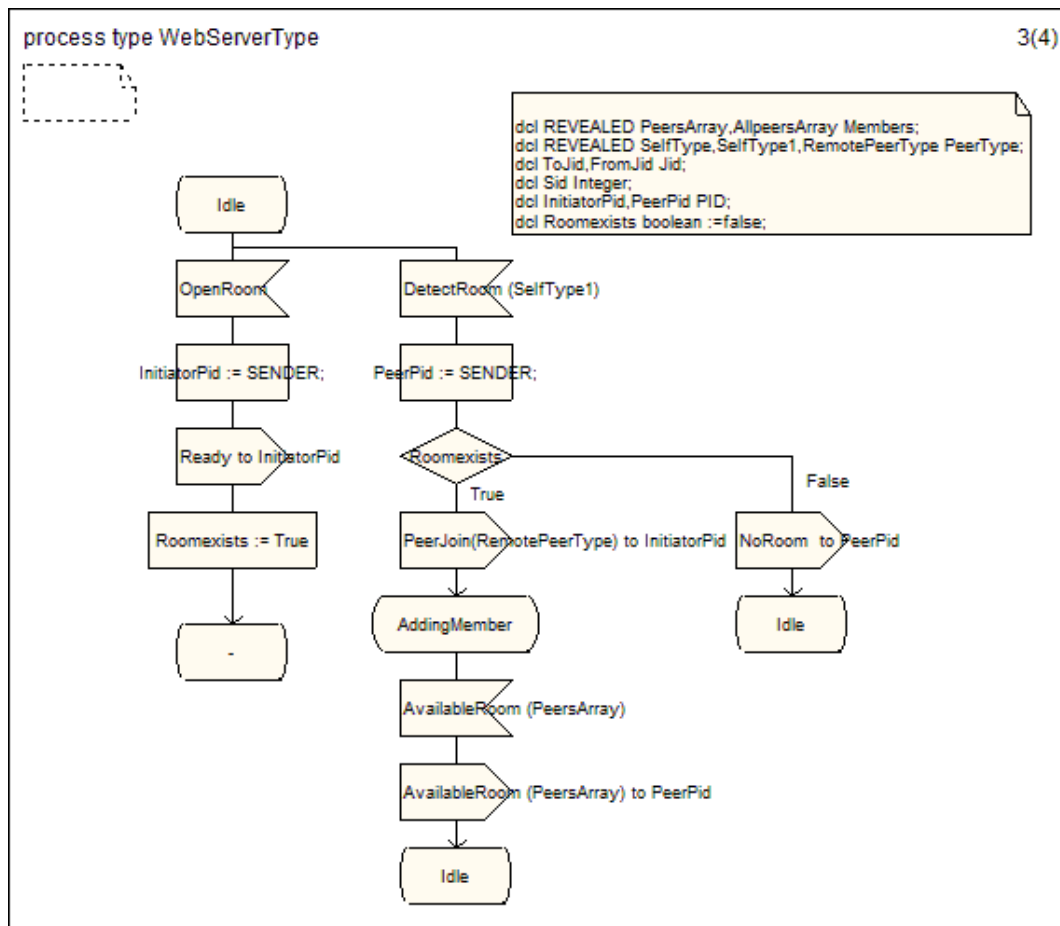


Figure 8. WebServerType Behavioral Diagram Extracts – b

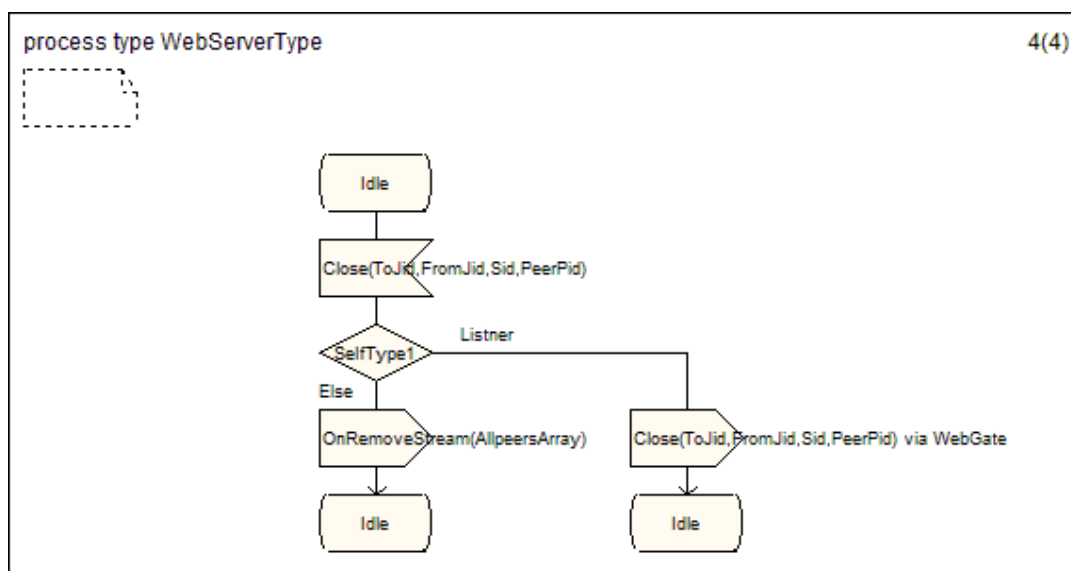


Figure 9. WebServerType Behavioral Diagram Extracts – c

The Figure 9 depicts the scenario of a peer leaving the conference by sending 'Close' signal. If the peer type is a 'Listener' the Web server simply sends a signal 'Close' back to the peer. In other cases, it sends the signal 'OnRemoveStream' with the array 'AllpeersArray' as a parameter, to permit to this peer to close all WebRTC Peer Connection to other peers of the same conference before leaving, see the MSC of Figure 15.

After the description of the process 'WebServerType', we present the process 'PeerConstructor' responsible of member creation. When the process 'PeerConstructor' receives the signal 'CreatePeer' from the WebServer, it stores the sender process id in the variable 'Srv'. Then it decides whether it can create an additional instance of WebRTC peer or the maximum number is reached. Each time the index 'k' is under a fixed value, here for example '31', the 'WebRTCpeer' process is created and its process id (offspring keyword for the parent process) is stored in the 'AllpeersArray', using 'k' number as an index.

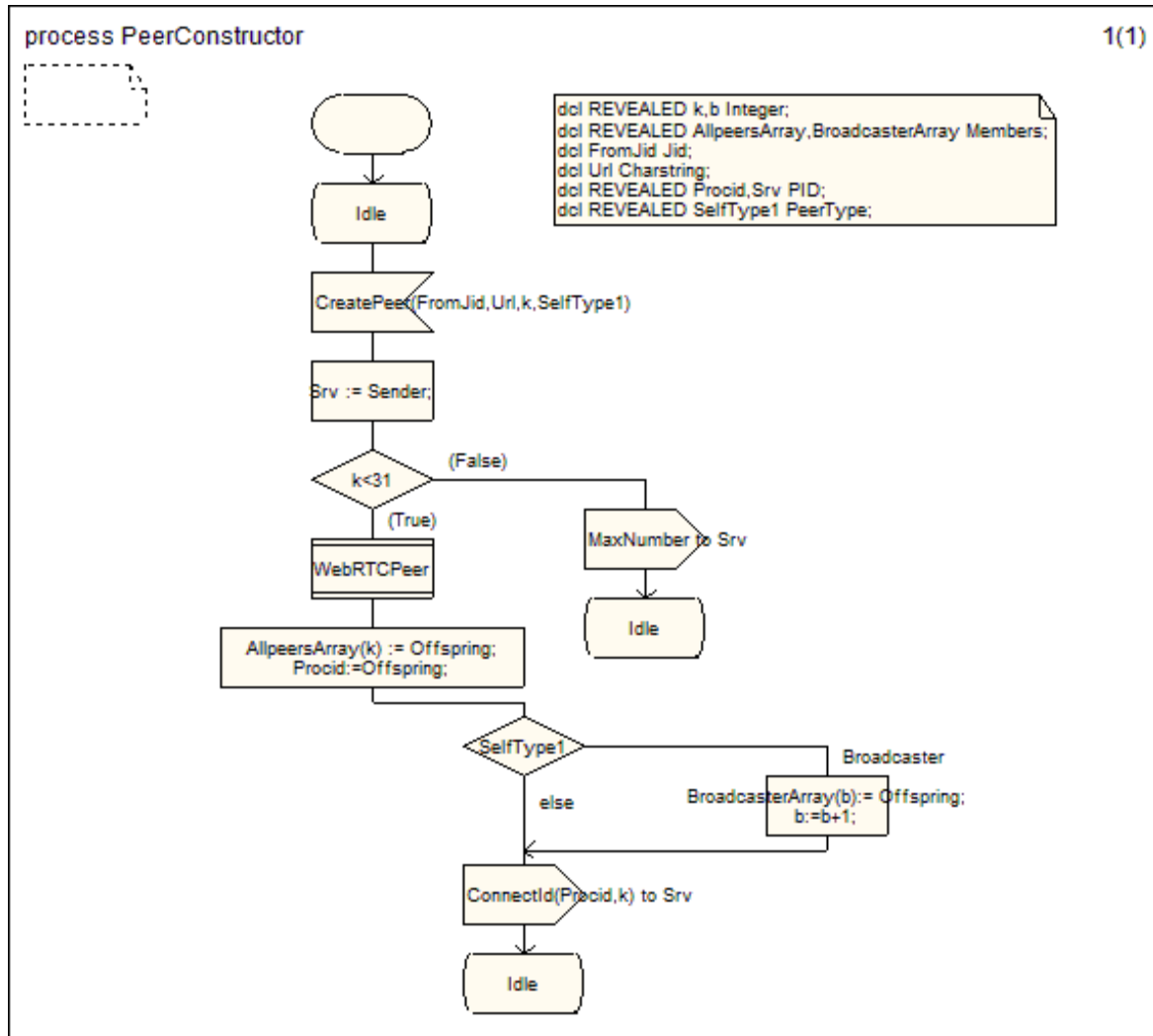


Figure 10. PeerConstructor Behavioral Diagram Extracts.

After, if the new peer is of type 'Broadcaster', its process id will also be stored in the 'BroadcasterArray', using 'b' number as an index, and 'b' will be incremented. This array is declared as a 'Revealed' variable, and will be used in other processes like 'WebRTCpeerType'. Finally, the output signal 'ConnectId' will be sent back to the WebServer. In the next section we introduce the package regrouping all data structures and signals of the model.

E. Data Representation of the Multiparty Conferencing in the Model

SDL utilizes Abstract Syntax Notation 1 (ASN.1), and offers a predefined package of most common types and operators. Besides, most operations on a type can be applied without regarding the actual implementation. For example, there is no limit to the size of an integer or length of an array. In addition to conventional data types, SDL

includes specific types such as time and duration. During the SDL data specification, we provide a formal definition for data types used in our model along with signal definitions. For a clearer specification, a number of new data types were constructed. Figure 11 shows an excerpt of “WebRTCMessages” package.

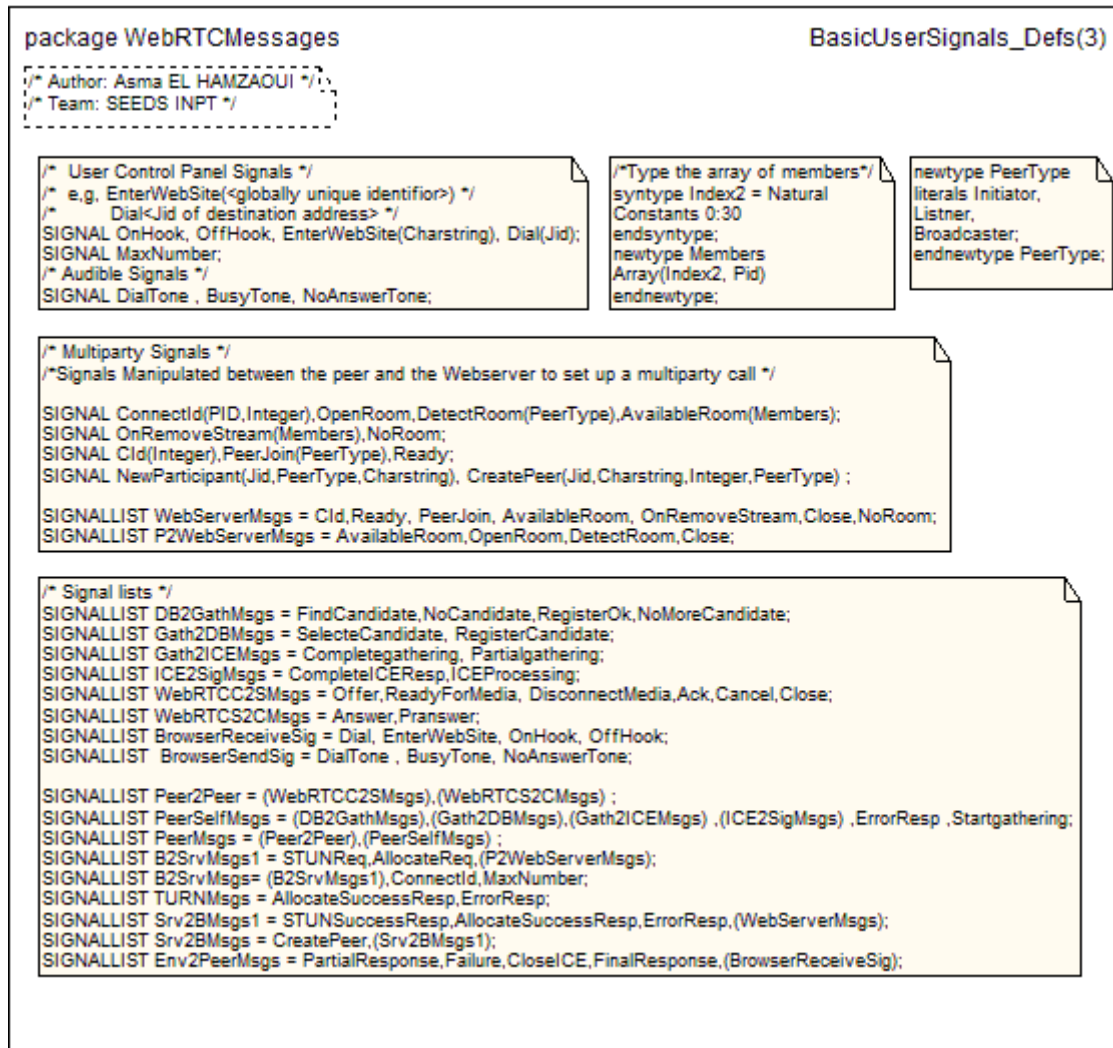


Figure 11. ‘WebRTCMessages’ package extracts.

The user controls the call session using a panel that sends signals like ‘OnHook’, ‘OffHook’, ‘Dial’... And he receives audible signals such as ‘DialTone’ and ‘NoAnswerTone’... Moreover, Figure 11 contains additional types defined to support new multiparty model features like the array ‘Member’ and the enumeration ‘PeerType’. In addition to signals used in the model for peer to peer communication, in this extended version we employ other signals manipulated between the peer and the Web server to set up a multiparty call. After this presentation of WebRTC Multiparty conference Model, we discuss now in the following section the validation of our SDL Model.

4. VALIDATION OF THE MODEL

Finding errors can be often a very hard task even for a specialist, because the human mind is fallible. In fact, many automatic tools had been developed for protocol validation. It’s considered to be a valuable aid in the discovery of flaws and imperfections. Formal validation is the application of formal methods to prove rigorously that a system complies with a set of studied properties. For that, the system in this work is modeled in a mathematical formalism.

Indeed, the SDL specification that has been discussed in the previous sections was constructed using the IBM Rational SDL and TTCN Suite version 6.3.

This tool offers many 'Reachability Analysis' features that permit validation of the system: 'Random walk', 'Bit-state', 'Exhaustive state' space exploration in addition to the option of 'MSC verification'. In this section, we present validation of our model.

A. Validation by Random Walk and Bit-state exploration

For the validation of our model, we adopt an interactive simulation. This means that when there was a choice between several SDL transitions to execute, we had to select manually the desired transition. For example in Figure 13, the participant could send either a 'DetectRoom' to join an existing room or an 'OpenRoom' to initialize a new room. In order to perform automatic simulations to test the maximum of model behaviors, the tool provides an automatic mode called 'Random walk', where the choices between several firable transitions are made randomly. The simulation runs by executing millions of transitions, to test the SDL model quickly. When an error is encountered, such as a range overflow or a bad behavior, the simulation stops, and the user gets the error message and can use the debugging features of the simulator to understand it (See the example of Figure 12).

On the other hand, the aim of exhaustive simulation is not only to execute all the SDL symbols at least once (static coverage) but also to execute all the behaviors of an SDL model (dynamic coverage): that means executing all the SDL transitions from all the global states. The global states are also called the reachable states. The global states and the transitions between them are an oriented graph, called the states graph, [21]. In this paper, we have tried exhaustive state space exploration but it could not be used due to the "state explosion problem". This is a standard problem caused by the size of the system state space that grows exponentially with the number of state variables in the system.

To overcome this constraint and in order to reduce memory usage during the graph exploration, the bit-state algorithm, [21] was used. It stores the hash-code of each model state instead of the whole state itself. Bit-state space exploration is particularly useful and efficient in checking for deadlocking interactions, but we note that it does not perform a true exhaustive simulation, because it is impossible to guarantee that a hash-coding function will not sometimes give the same result for two different states.

Furthermore, Rational Tau uses a predetermined set of test values for each data type. For instance, for an integer type, the test values are: 0, 55, -55. This is why it didn't perform 100% state space coverage. As an example, in the list of default signals generated by the tool to perform bit-state exploration, we find this signal with testing parameters: `NewParticipant((. 10, 'test', 'test', 'test' .), 'test')`.

It's assessed not adequate to cover all possible transitions of the overall system. Consequently, it was replaced by three signals:

```
NewParticipant((. 1, 'test', 'test', 'test' .), 'Initiator', 'test')
NewParticipant((. 1, 'test', 'test', 'test' .), 'Broadcaster', 'test')
NewParticipant((. 1, 'test', 'test', 'test' .), 'Listner', 'test')
```

Figure 12 shows that errors are raised through a textual report or via a graphic user interface named 'Report Viewer'. This report can generate on demand a 'ValidationTrace' to help the designer to correct the error. This procedure is repeated until it can be guaranteed that the model is free of faults.

The error detected in Figure 12 is that signal 'PeerJoin' didn't find a receiver. So the signal is discarded. When analyzing the situation where this behaviour is found, we understand that this is caused by a participant to the conference that joined a room before an initiator could initialize or create the room with this specific 'URL'. If we look at the SDL model shown in Figure 13, we didn't find any condition that prevents a peer from joining an inexistent room. The solution was to use the Boolean variable 'Roomexists' to enable taking the decision. The corrected diagram is presented previously in Figure 8.

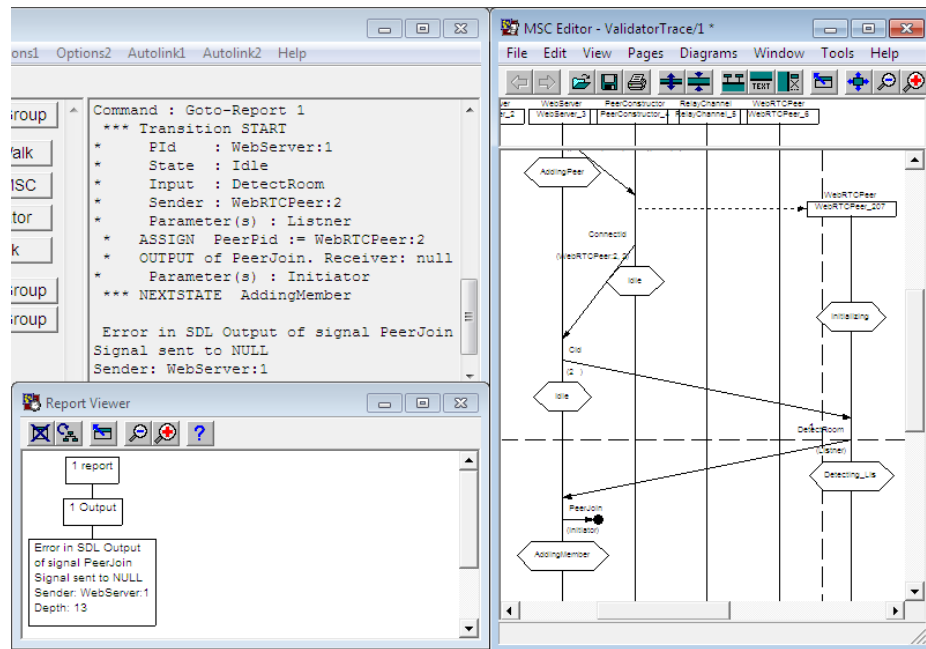


Figure 12. Error report and Validator trace example.

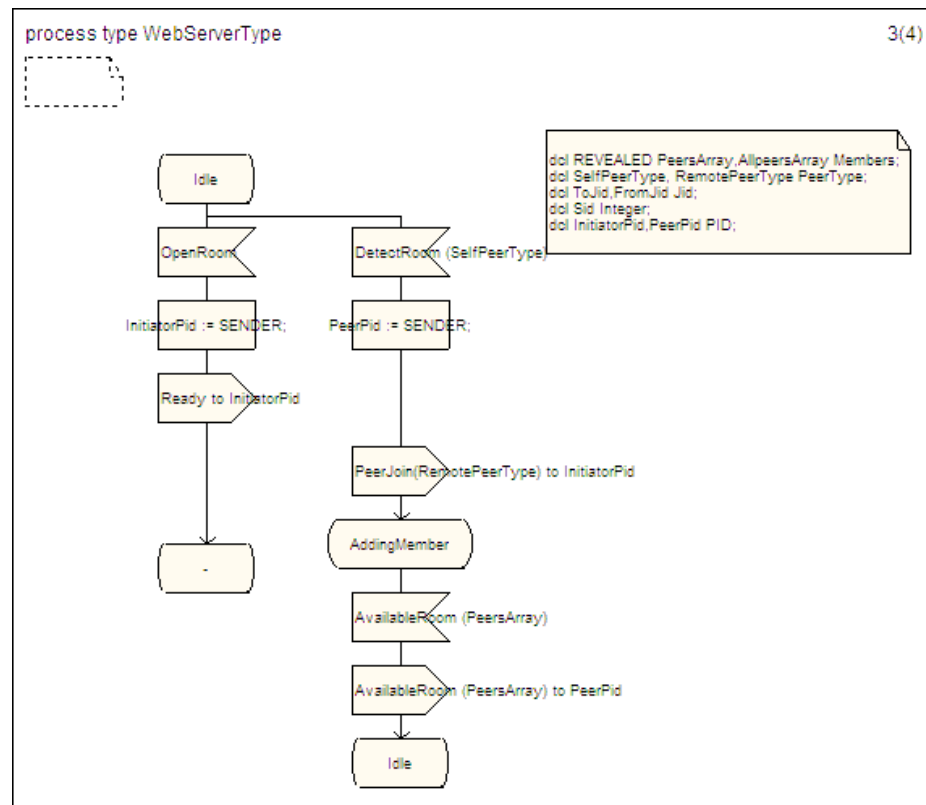


Figure 13. WebServerType Behavioral Diagram Extracts before error correction.

B. Validation against MSCs

The behavioural properties express the expected behaviour of the system at some level of abstraction. A behavioural property is in our case modeled by MSC test scenarios. Behavioural validation is then a comparison

between two models: the program model and the model of the property. Some examples of behavioural validation are presented in the following subsections:

1) Conference Establishment:

To work with the “Verify MSC” feature of Rational Tau, we used the scenarios described informally in subsection 3-A, and rewrote them in the form of MSCs. Then we checked that our SDL model was able to generate the given MSC. An MSC is verified if it exists an execution path in the SDL model such that the scenario described by the MSC can be realized.

In the first MSC of Figure 14, we present the steps to create two WebRTC Peers: An ‘Initiator’ who opened the room and a ‘Participant’ who detects the existence of the same room by asking the ‘Webserver’ to ‘DetectRoom’. After that, this latter informs the initiator that a peer is joining (‘PeerJoin’ signal). The initiator responds by a signal ‘AvailableRoom’ to the Web server who forwards this response to the ‘Participant’.

The verification of this MSC ensures that the dynamic creation of peers is possible and the sequence of desired events was indeed possible through interactions between the environment, the Web server, the Peer Constructor, and the created WebRTC peers.

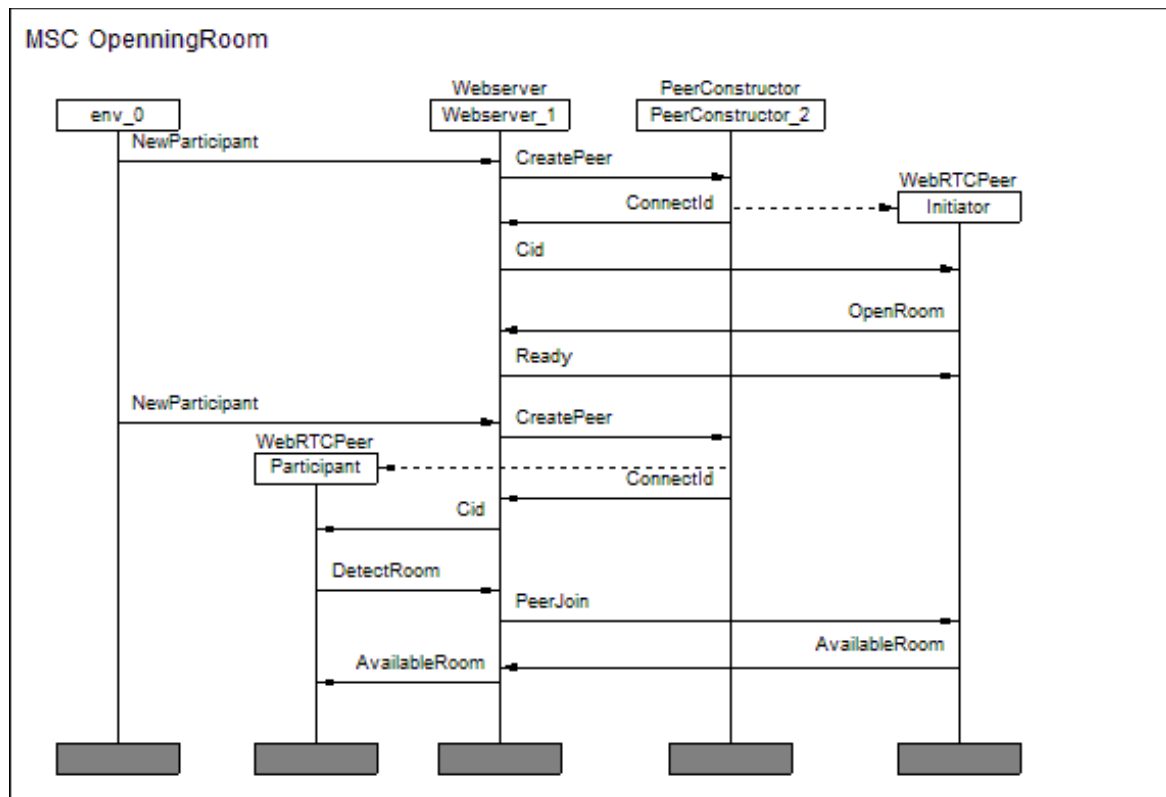


Figure 14. The step of opening and detecting the conference room.

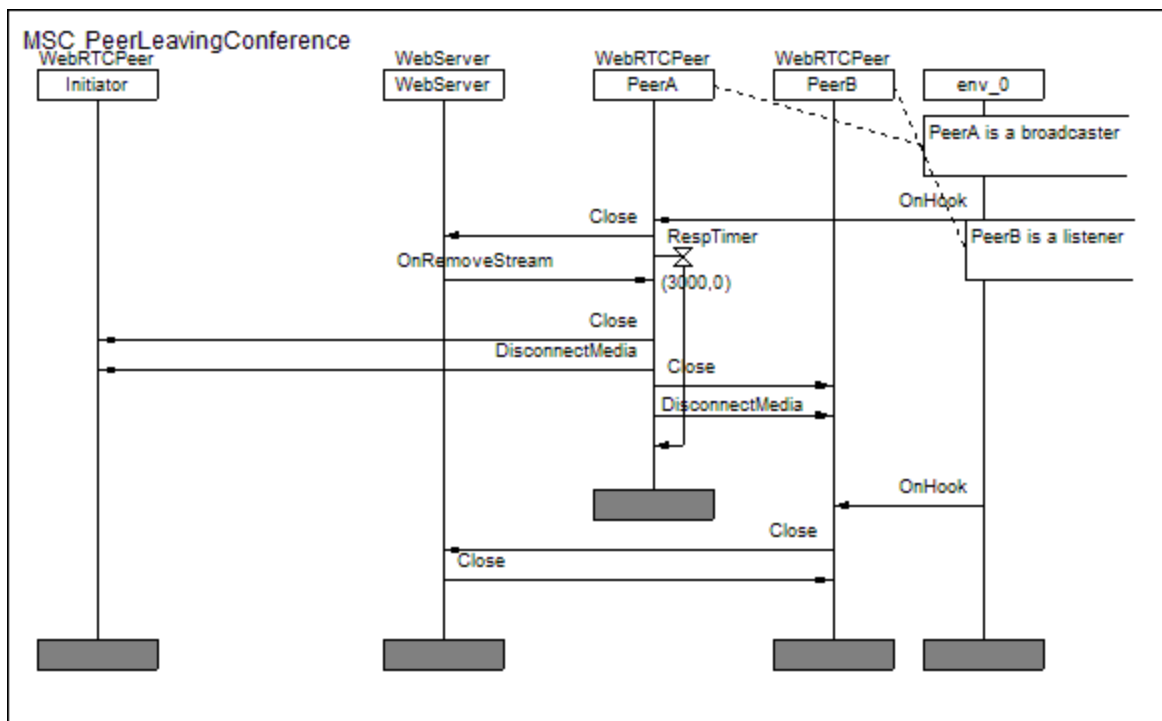


Figure 15. Peers are leaving the conference.

2) Conference Termination:

The MSC of Figure 15 describes the scenario of a peer leaving the conference. 'PeerA' is a 'Broadcaster'. When it decides to leave the room, it sends a 'Close' signal to the Web server. In return, it receives 'OnRemoveStream' with an array containing a list of all process identifiers of other peers that receive streams from the broadcaster 'PeerA'. Getting this message, 'PeerA' sends duplicate messages of 'Close' and 'DisconnectMedia' signals to the other participants of the conference i.e.: to the 'Initiator' and to 'PeerB' before leaving. In contrast, when 'PeerB' which is a 'Listener' decides to disconnect, it sends simply 'Close' message to the Web server and receives an acknowledgement. After little iteration of test and refinement, we were able to come up with a final model that passes all test scenarios (no MSC violations).

5. CONCLUSION AND FUTURE

The main contribution of this paper is the novel hybrid architecture proposed for WebRTC multiparty conferencing systems, and the formal model of the architecture using the SDL language. The SDL model covers the important characteristics of a Multiparty Web Real-Time Conferencing Architecture. Additionally, we have used MSCs to characterize user interaction scenarios and used these scenarios to validate the SDL model of the system. Finally, our experience with validating our SDL model via different algorithms is also described. By iterative manner, we restarted the exploration to detect potential faults in the model and nonsimulated parts. And after correction and refinement, we could validate the resulting model.

In the future, we consider extracting a Promela model from this SDL model and realize a formal verification of the extracted model with the Spin model checker. Also, according to the functional and non-functional requirements of WebRTC video conferencing system, we will model an overlay topology for the signaling and control plane.

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FPGA and ASIC Implementation of Speech Encryption and Decryption using AES Algorithm with Speech Recognition

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Abstract - With increasing technology development in field of communication and Electronic devices, there is a need for better security service for information transfer in Medical Sectors, Banking, Financial and in other IoT applications etc. Fight against security attacks is of prime importance. Through Cryptographic techniques we can provide Authenticity as well as Confidentiality for the user data. In this paper, hardware implementation has been described for a real-time application of speech data encryption and decryption using AES algorithm along with the speech recognition using cross correlation technique. Verilog programming environment is used for AES cryptography whereas MATLAB is used for Speech recognition. ASIC design on AES core is implemented using Cadence tools. Number of gates, area and power used by AES core design has been drastically reduced by specifying wide range of constraints during front end designing. In Backend designing, layout of AES design, which is the physical geometric representation is also developed.

Keywords— Advanced Encryption Standard (AES), Field programmable gate-array (FPGA), Application specific integrated circuit (ASIC), Speech Recognition, Cross-Correlation

I. INTRODUCTION

Security and privacy happens to be the two major aspects of ever-growing speech communication system. Shadow Brokers, WannaCry, Goldeneye, Cloudbleed are some of the Biggest Cybersecurity Disasters so far. Speech cryptography is the method of sending information which has been spoken in a masked way by carrying out encryption of data at transmitter end and decryption at receiver end. Cryptography is a method used to detect the masked messages. Encryption involves scrambling of the original data, and the reverse process constitutes decryption [2].

Speech recognition comes under the field of computing language which is used to develop methods and technology which can be used for enabling the recognition and translation of spoken language into text by the computer [6]. The speech file obtained will be encrypted on an FPGA. Then the encrypted file will be transferred to another FPGA for decryption which is in turn transferred to a computer in which original speech is recovered using the MATLAB. Cross correlation technique can also be used to carry out speech recognition through MATLAB [7].

Block diagram which describes the functionality of the system is as shown in figure 1. Samples of Speech signal is acquired using MATLAB and are stored in .txt file. These samples are passed on to an FPGA module(NEXYS 4 DDR fpga) to carry out the encryption. Receiver side represents the FPGA decryption module(NEXYS 4 DDR fpga) to which the encrypted samples are sent. Both fpga modules can be connected through RS232 communication link [4]. Decrypted samples represents are the original speech samples. If these samples are read through MATLAB at specified bit rate, user speech is obtained. Cross correlation technique is used to pass this user speech through speech recognition system .

This paper is organized as follows where Section II gives a brief introduction of Cryptography, AES and Speech Recognition. Section III describes the simulation results obtained with respect to MATLAB and FPGA. The ASIC implementation is discussed in section IV. The paper is concluded in section V.

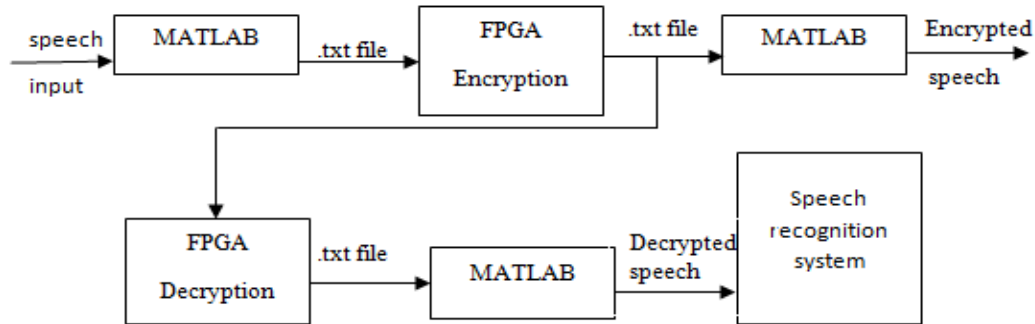


Figure 1. Block diagram of the proposed system

II. DESIGN

A. Cryptography

Cryptography is defined as the method of creating codes which allow the information to be hidden. It converts the original data of the user into an unreadable format for an unauthorized user, due to which the unauthorized readers cannot decode it. Information security field makes use of cryptography in different aspects. A key is very essential to decrypt the user information. Integrity and privacy of the information is conserved both during transmission and storage. Symmetric and Asymmetric Cryptography happens to be the two types of cryptography.

Asymmetric cryptography or public key cryptography, uses both public and private keys for encryption and decryption of data. Encryption of plain text and decryption of cipher text is done using the same symmetric key algorithms. AES happens to be a Symmetric Key cryptographic algorithm.

B. AES algorithm

AES works on a 4×4 column-major order matrix of bytes, which are called "state". Depending on the version used to convert the plain text into the cipher text, the key size varies. The number of rounds constituting repetition are as follows:

- Ten rounds for 128-bit keys.
- Twelve rounds for 192-bit keys.
- Fourteen rounds for 256-bit keys.

Each round contains several processing steps, where each step contains four similar but different stages which includes one that depends on the key for encryption. Reverse set of rounds are applied to convert cipher text back to the plain text by using the same encryption key [5].

Four steps of AES are as follows:-

1. SubBytes—It is a substitution step, where each byte is replaced with another byte based on the predefined S-box.
2. ShiftRows—Here four rows will be left shifted cyclically by 0, 1, 2 and 3 bytes respectively.
3. MixColumns—It is a mixing operation, Galois field multiplication takes place on each column of the state, generating a new state as output.
4. AddRoundKey—In this step, Bitwise xor operation is carried out between each byte of the state and the round key.

Since, AES-128 bit version is used here, initial 128 bit key is expanded to 1408 bits needed for 10 rounds of operation using Key expansion algorithm. AES utilizes key expansion process in which all round keys are generated from single 128-bit cipher key to create round key for each round. The keys that are generated are of 128-bits length each. All the rounds are symmetric in nature and key expansion process is used to eliminate the symmetry by having round dependent round constants. The possibility of

equivalent keys is eliminated by nonlinearity of key expansion. There is no need for the mixing transformation in the last round of encryption. The Last round of encryption module outputs a 128-bit cipher text.

Decryption happens to be the inverse process of encryption which involves inverse round transformations which are applied to cipher text in order to get back the original data. Flow is described in the Figure 2 below.

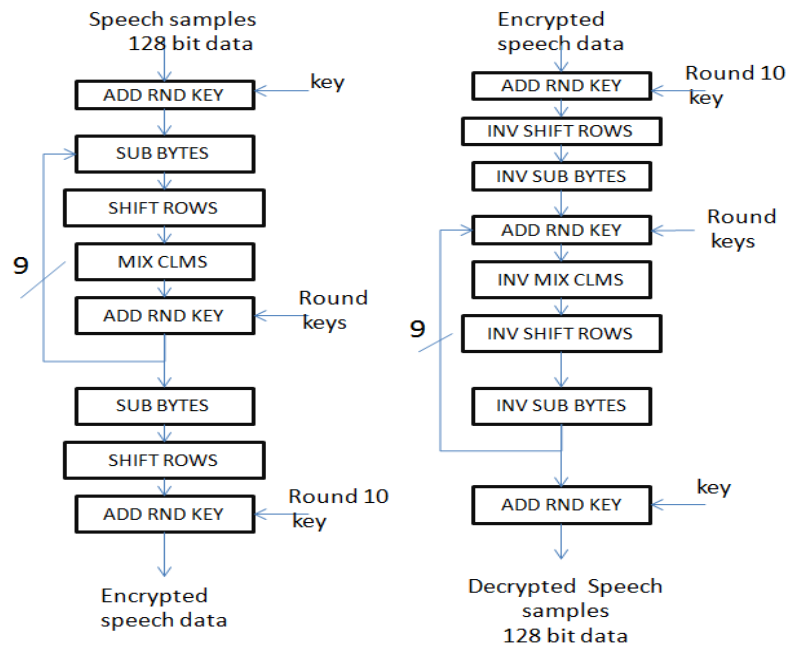


Figure 2. AES-128 bit Encryption and Decryption Flow

C. Speech Recognition

Speech Recognition is defined as the method of capturing the spoken words using a microphone and hence converting the voice signal into a digitally stored set of data. Speech recognition is used widely in most of the security project where there is a need to tell your password to devices like computer to provide access to system applications.

The measure of similarity of two series as a function of displacement of one relative to the other is called as Cross correlation [8]. It can also be called as the sliding dot-product or the sliding inner-product. It is commonly utilized for searching a long signal for a shorter one. Pattern recognition for single particle analysis also finds applications in cross correlation. The xcorr function of MATLAB happens to be a Cross-correlation function for a random process which includes autocorrelation. Syntax for Correlation in MATLAB can be written as $r = \text{xcorr}(x,y)$

where $r = \text{xcorr}(x,y)$ returns the cross-correlation of two discrete-time sequences which are named x and y.

D. Algorithm describing Speech Recognition using Cross- Correlation technique

Consider sample as voice where $x=\text{voice Read}$ and compute x and store in y1. Consider total of 4 samples containing different voice data [8].

- 1) $z1 = \text{xcorr}(x,y1)$, $m1 = \max(z1)$
- 2) Repeat steps 1 for all 4 samples.
- 3) Consider $a = [m1 \ m2 \ m3 \ m4 \ m5]$ where $m5=300$, $m5$ is the threshold.
- 4) Compute $m = \max(a)$
- 5) If $m \leq m1$ read 1st file
- 6) elseif $m \leq m_i$, read ith file where $1 < i < 5$
- 7) else read denied file
- 8) End

III. RESULTS AND DISCUSSION

The functional design code was written using Verilog HDL (Hardware Description Language) and synthesised in Vivado Design Suite. The proposed design has been implemented on NEXYS 4 DDR (XC7A100T-CSG324) boards [1] & [3]. VIO (Virtual Input Output) debugging tools were used in implementation.

Simulation results of encryption module and decryption module are as shown in Figure 3. and Figure 4. respectively. The resource utilization details of FPGA by encryption system and decryption system are mentioned in Table 1.

A. AES ENCRYPTION

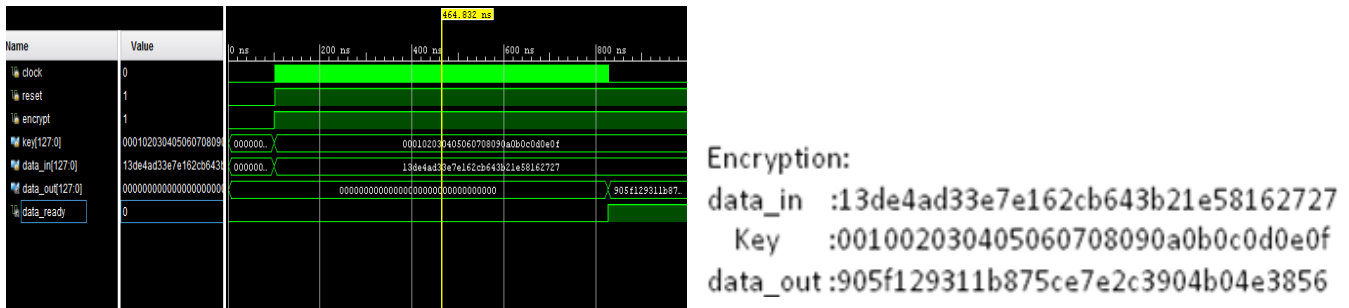


Figure. 3 Simulation Results of AES Encryption on NEXYS 4 DDR

B. AES DECRYPTION

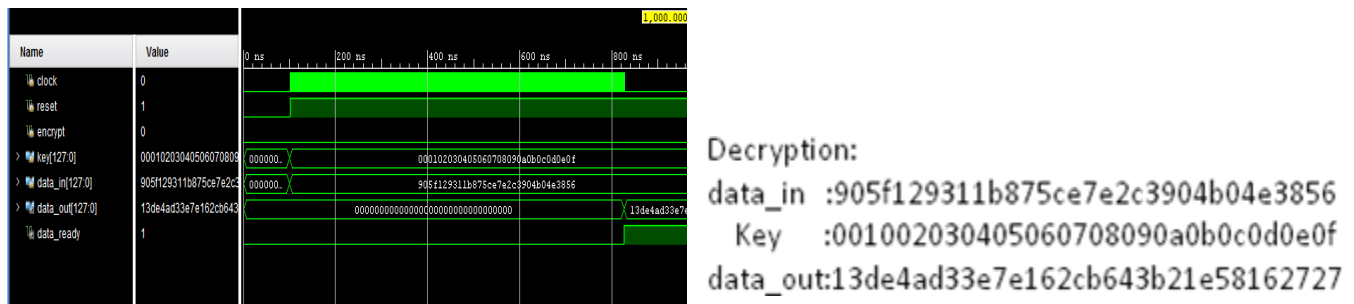


Figure. 4 Simulation Results of AES Decryption on NEXYS 4 DDR.

Resource	Estimation	Available	Utilization
LUT	2365	63400	3.73%
FF	1548	12080	1.22%
IO	1	210	0.48%
BUFG	1	32	3.13%

Table 1 - Resource Utilization Table with respect to NEXYS 4 DDR fpga

C. Speech Recognition Results

The graphs for comparison between the test and the sample audio files is derived using MATLAB [8]. Two of the test files and four of the sample files which has speech (Spoken word) of one to four are considered. One of the test file will have a match from four sample files and another test file has no match with any of the stored sample files. The loop starts which takes test file as input cross correlated with other samples and the output graph is displayed using MATLAB. So, after cross correlating with 4 other samples we will have four output graphs as shown below. Considering that the 'test.wav' file is a match for the second sample, the comparison of the sample will start when the input speechrecognition('test.wav') is given in MATLAB. The results have been described in figure 5(a) below.

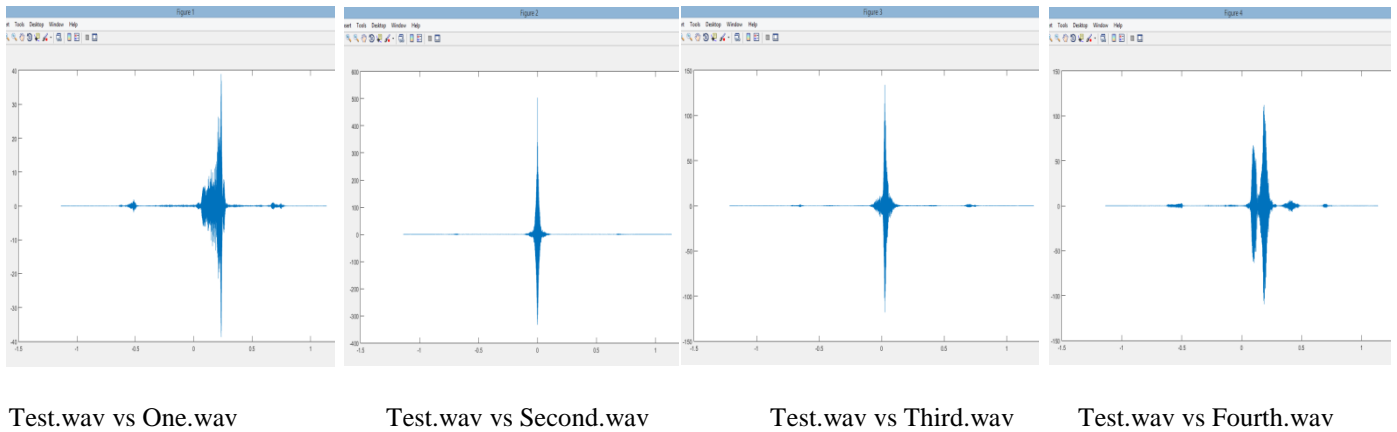


Figure 5(a). Speech Recognition Test Case 1

Now consider the test file ('ten.wav') which does not match with any of the samples given. With the given input MATLAB command prompt, the comparison will start and it will tell denied which means the file is not matching with any of the sample files. Results for this case is described in below figure 5(b).

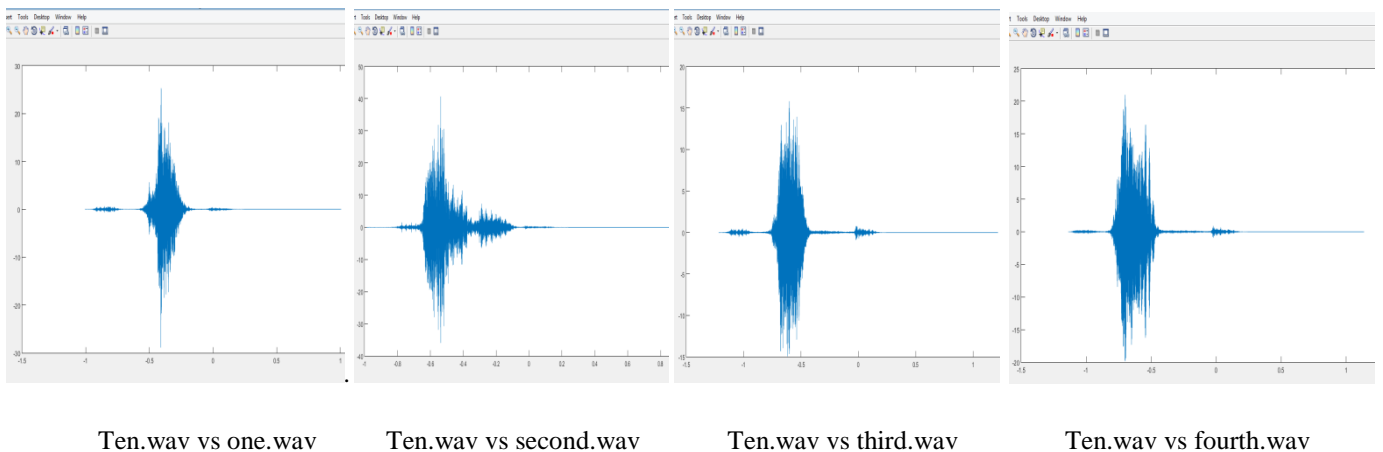


Figure 5(b). Speech Recognition Test Case 2

Cross correlation technique works on pattern matching and is not the ideal solution for speech recognition. If two different signals with similar pattern undergo cross correlation it may give wrong results. So enhanced speech recognition system should be implemented [6].

IV. ASIC IMPLEMENTATION

ASIC can be optimized for requiring low power, speed, design flexibility with small form factor. Clock gating, power gating, pipeline etc. are available in ASIC which are not in FPGA. In ASIC you can implement analogue circuit and mixed signal designs which are not possible in FPGA. Rather than implementing for general purpose ASIC can be customized for a particular use.

A. Front End Design

It is the first part of ASIC designing. Designer will describe system specifications, which is converted into a VHDL or Verilog language. Functional verification or behavioral simulation is performed to ensure the RTL design done is working according to the specifications. Next step is Synthesis.

Synthesis converts the verilog or VHDL code into gate level netlist. according to specified constraints. It takes into account power, speed, size and hence the results may vary much from each other. Verification is done to find out whether generated netlist specifies the logic. Table 2 describes the before and after synthesis results for the functional code written. The HDL code to RTL synthesis is influenced by constraints. Wide range of synthesis constraints are available which basically depends upon the tool used. Specific Input/output pins are assigned signals using I/O constraints. Timing requirements of a design are used to specify a timing constraints. Internal timing connections like delays through logic, LUTs and between flip-flops or registers are influenced by these constraints. Area constraints maps wide range of resources in an ASIC. Location constraints describes location of an element with respect to specific or relative designs within ASIC. Constraints used in our design is shown in the figure 6.

```
constraints_top.sdc
create_clock -name clock -period 10 -waveform {0 5} [get_ports "clock"]

set_clock_transition -rise 0.1 [get_clocks "clock"]
set_clock_transition -fall 0.1 [get_clocks "clock"]
set_clock_uncertainty 0.01 [get_ports "clock"]

set_input_delay -max 1.0 [get_ports "encrypt"] -clock [get_clocks "clock"]
set_input_delay -max 1.0 [get_ports "reset"] -clock [get_clocks "clock"]
set_input_delay -max 1.0 [get_ports "data in"] -clock [get_clocks "clock"]
set_input_delay -max 1.0 [get_ports "key"] -clock [get_clocks "clock"]

set_output_delay -max 1.0 [get_ports "data out"] -clock [get_clocks "clock"]
set_output_delay -max 1.0 [get_ports "data_ready"] -clock [get_clocks "clock"]

set_max_area 0

set_max_capacitance 1.0 encrypt
set_max_capacitance 1.5 reset

set_max_dynamic_power 1250000
set_max_leakage_power 250000
```

Figure 6. Constraints used to optimize design

Parameter	Before Synthesis	After Synthesis
Gates	21829	16559
Area	841091 sq. microns	95291sq. microns
Leakage Power	1662527 nW	355483 nW

Table 2 - Synthesis Result for AES

B. Back End Design

The gate level netlist is mapped to a complete physical geometric representation in the back end design. The first step involves floor-planning where we place various blocks and I/O pads across the core design area based on the constraints given. Then physical elements are placed within the core area, tool may place the cells close to each other or at a far distance to help meet timing requirements. After placing all the elements, clock tree synthesis and detailed routing is done to connect all of the elements together and also to supply voltage. All the above process is shown in Figure 7. After this phase, a requirement arises to complete simulation to ensure the layout phase is properly done.

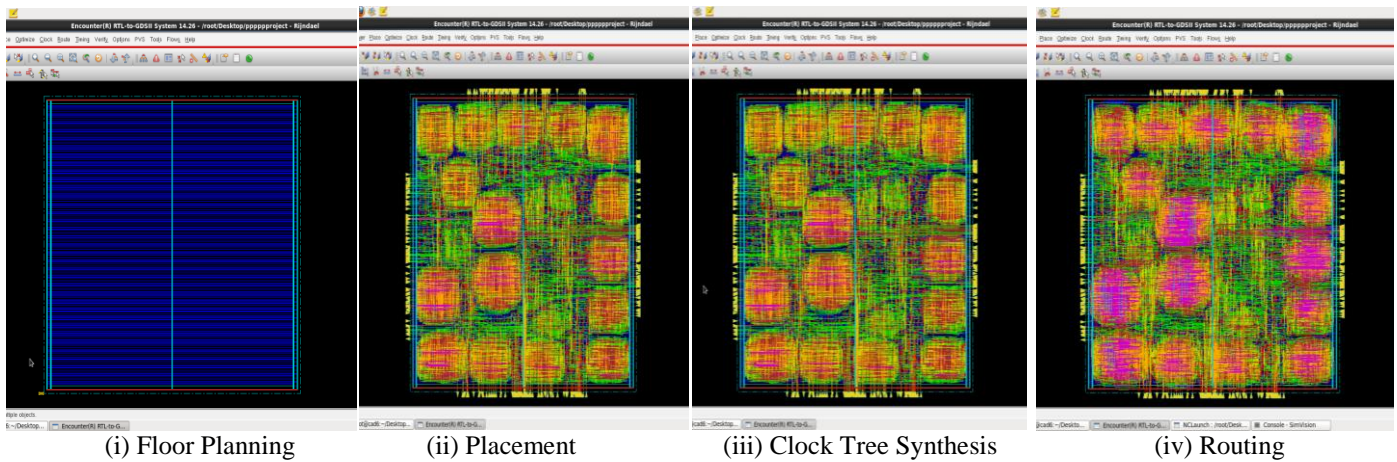


Figure 7. Backend design

GDSII (GDS2) file is produced as the end result of the Layout, it is used by the foundry to fabricate the silicon. The layout should be done according to the silicon foundry design rules.

V. CONCLUSION

In this paper, Speech data obtained through MATLAB has been encrypted and decrypted successfully using AES algorithm in verilog programming environment. Decrypted speech is recognised using cross correlation technique. AES has never been cracked and is considered most secure against any kind of brute force attacks. In ASIC designing, the constraints given for synthesis have reduced gates, area and leakage power by 24%, 88% and 78% respectively, as described in table 2. So we need comparatively lesser amount of resources to implement the design, which makes the design smaller, faster as well as energy efficient. Layout of AES design is also developed in Backend design. In future we wish to develop more accurate speech recognition system and further optimization can be done for minimizing the required area, gates and power on ASIC for high end applications.

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Implementation of FAQ Pages using Chatbot

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ABSTRACT

A website or an app is a customary way that a business adopts to provide their services to their customer base. However, given the limited storage in the phones, not many users will be willing to download an app to get their queries addressed. Going to company website is also time consuming. In general, when the consumers face issues, they reach out to the customer support. More often than not, it takes a long waiting time to reach the customer service representative. Not to mention, these calls are not always satisfactory. Interacting with customers and retaining those customers becomes difficult for the businesses with a wide audience to cater. Chatbots provide an option that can be used by businesses to address the general queries of the user. These are chat-based software that understand anything user types or says and accordingly replies and takes actions. The recent developments in the field of artificial intelligence have made chatbots more intelligent and adaptable for being a substitute to FAQ pages.

Keywords—Chatbots, Artificial Intelligence, FAQ pages

INTRODUCTION

FAQ page is section of a website that becomes a go-to destination for the customers. This page is one of the most important pages on the website and helps the business increase its online presence and drive qualified traffic to its site. Many companies have realized this and have spent a lot of time and effort in improving the content of their FAQ pages and also the way this content is being served to the user base. Chatbots offer a simple solution to this issue.

Chatbots have been there for some time now. They have been gaining a lot of popularity ever since they hit the market. Despite this not a lot of companies have used them as a replacement for their FAQ pages. The reason has something to do with the way chatbots have been implemented in the past. The chatbots of the past have not been intelligent. These chatbots have not showcased an ability to have human like conversation with the users. The traditional chatbots have used buttons and decision tree models, a technique that has been employed by call centers in past with limited success. In technical terms, these chatbots were not conversational. There are lots of problems involved when users are forced to choose from a set of options. It is likely that at some point of time during the conversation, the option they need is not part of that set. Moreover, there is a chance that they try to ask question to a user in a form that is not understood by the chatbot. Another issue worth considering is that if the user changes his mind during a conversation, he won't be able to go back on that decision and will be left with no options but to start over. The industry needs a conversational chatbot now more than ever.

In this paper, we aim to propose a model of a conversational chatbot that can be used by the industry as a substitution for their dull FAQ pages. Deep learning concepts can be used to create an intent and entity recognition model. Intents are classes that highlight the main communicative essence in the user input. Entities are words of value in a user input. Each user input may contain zero or more entities contain key information important to the ongoing conversation. Common examples of entities include *names of organizations*, locations and *prices*. Once the intent and the entities are recognized, the remaining part of the job is to generate a suitable response from the knowledge base. Just replying in text format won't be enough, to reply more human like experience, it must provide voice interaction as well.

RELATED WORKS

Most of the chatbots in the industry are rule based. The knowledge of these chatbots are stored in the form of patterns and templates. When the user query matches one of the patterns, the response stored in the <template> is sent to the user. The <pattern> could be a simple sentence like "what is income tax?" or a string with regular expression like "what is *?". The <pattern> and <template> are handwritten.[1]

An inherent problem with this approach is finding an appropriate algorithm to match user queries to a particular <pattern>. Eliza, one of the earliest chatbots created in 1964 at the MIT Artificial Intelligence Laboratory by Joseph Weizenbaum used an interesting approach.

Eliza used incremental parsing for pattern matching. All the words in the user input were parsed and looked for in the dictionary. Each word was given a priority based on importance and stored on a keyword stack. The word on the top of the keyword stack was tried to be associated with one of the patterns. Based on the pattern match, a suitable reply stored in template was generated. In case an association with a pattern could not be made, a default reply like “I see”, “Please go on” was displayed. [2]

ALICE, a later implementation of chatbot, inspired by ELIZA used a different technique for pattern matching. The knowledge of ALICE was stored in Graphmaster, a graph with nodes and edges. The path to every leaf node is a sentence or a user query, the reply for which is stored in that particular leaf node.

The problem with all the rule based approaches is that the rules must be provided by the programmer .A lot of time and effort is required in writing such rules. [3]

PROPOSED WORK

A lot of developer’s time will be saved if they can utilize the large sets of chat logs on various chat platforms like Twitter and Facebook. Instead of classifying the sets into questions and responses, deep learning techniques can be used to recognize intents and entities in the user input and map these intents and entities to a suitable response stored in a database.

As shown in Figure 1, a user starts the conversation by asking a question which is sent to the ChatBot. The ChatBot then processes the input query and generates the response for the user which is sent as a reply to the user.

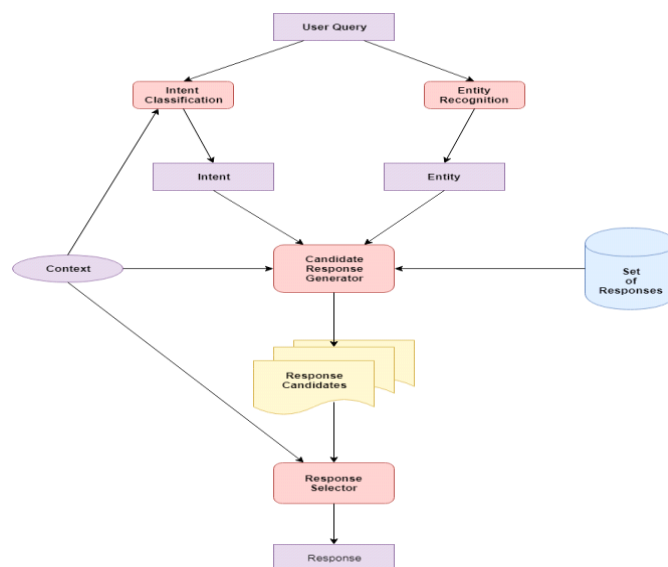


Fig 1: Block diagram of intent and entity recognition process

If the ChatBot is unable to find suitable answer or response for the input query it sends the query to the admin. The admin can check the log file to find the unanswered queries and adds the suitable response in the form templates and updates it back to the ChatBot. This continuous process helps in learning through user interaction and if the same question is asked again the ChatBot is able to answer it.

ChatBot controls conversation flow based on the context of the user's requests and responds with natural language phrases to provide direct answers, requests additional information or recommended actions that can be taken.

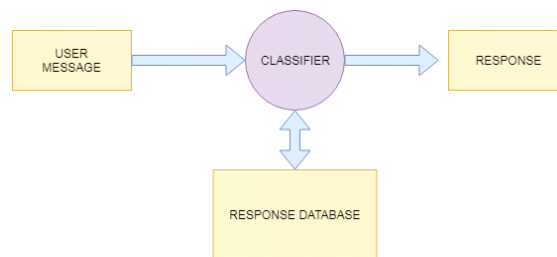


Fig 2: Basic Conversation Flow

Figure 2 provides a high level description of how a chat client could be used to leverage natural language processing to assist with access to content or perform data queries.

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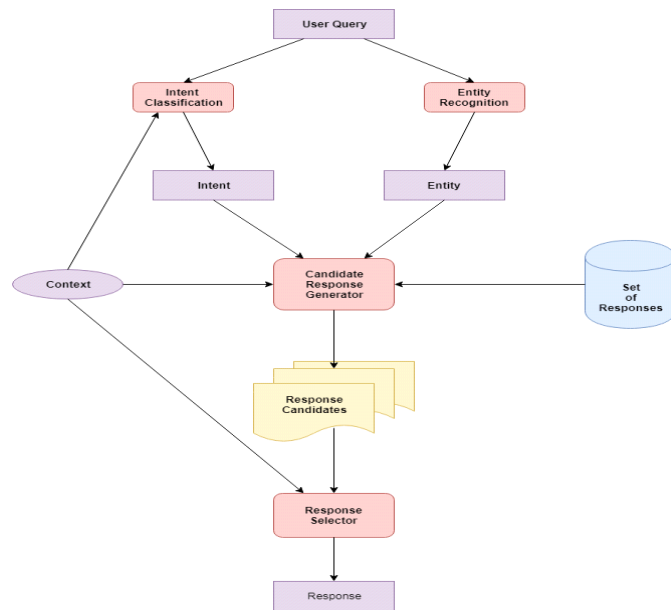


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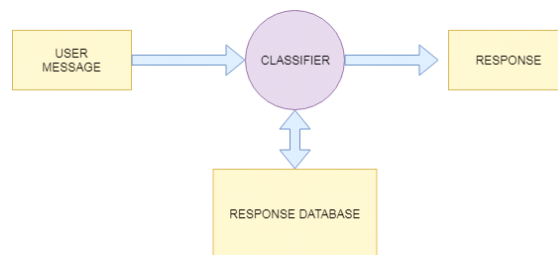


Fig 2: Basic Conversation Flow

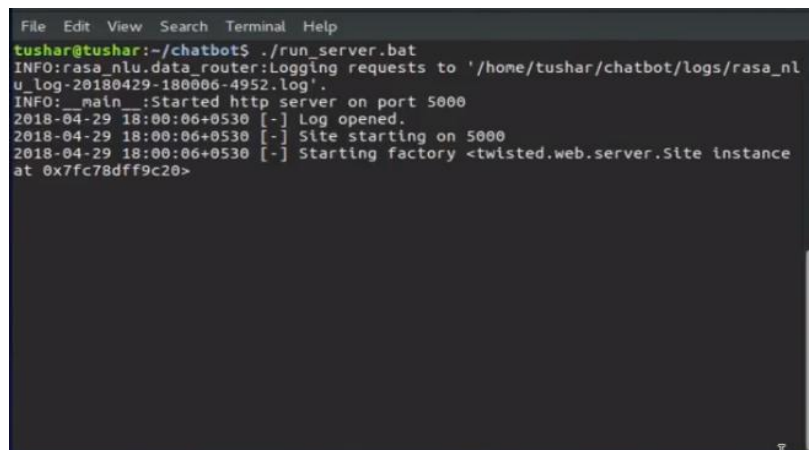
Figure 2 provides a high level description of how a chat client could be used to leverage natural language processing to assist with access to content or perform data queries.

RESULT

```
File Edit View Search Terminal Help
tushar@tushar:~/chatbot$ python app.py
* Running on http://127.0.0.1:8080/ (Press CTRL+C to quit)
* Restarting with stat
* Debugger is active!
* Debugger PIN: 225-861-028
```

The screenshot shows a terminal window with the RASA server running. The output indicates it is running on http://127.0.0.1:8080/, restarting with stat, and has a debugger active with PIN 225-861-028.

Figure 3a: RASA Server



```
File Edit View Search Terminal Help
tushar@tushar:~/chatbot$ ./run_server.bat
INFO: rasa_nlu.data_router: Logging requests to '/home/tushar/chatbot/logs/rasa_nlu_log-20180429-180006-4952.log'.
INFO: __main__: Started http server on port 5000
2018-04-29 18:00:06+0530 [-] Log opened.
2018-04-29 18:00:06+0530 [-] Site starting on 5000
2018-04-29 18:00:06+0530 [-] Starting factory <twisted.web.server.Site instance at 0x7fc78dff9c20>
```

Figure 3b: Flask Server

Figure 3a and 3b show the RASA server and Flask server. The Flask server takes user input from client interface and passes it onto the RASA server.

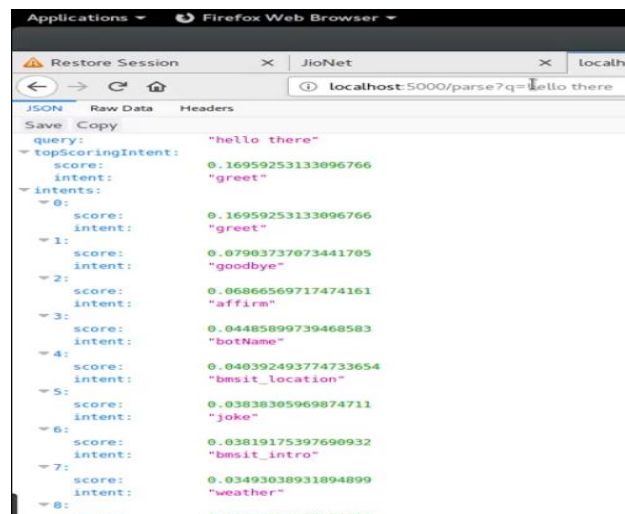


Figure 4: RASA server's response

Figure 4 shows the RASA server's response to a query in json format. The figure shows how intents are ordered in terms of the confidence order.

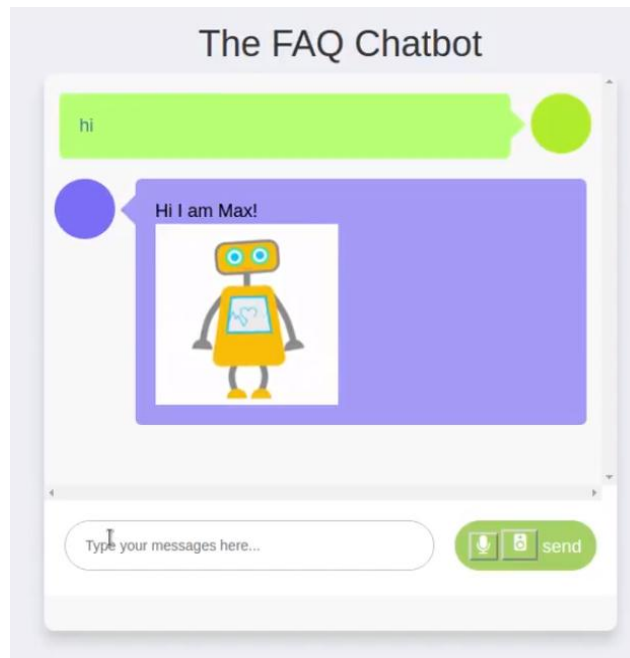


Figure 5a: Interactive chat client interface



Figure 5b: Interactive chat client interface

Figure 5a and 5b show the interactive chat client interface. It shows the send button, speak button and listen button. These buttons are used for textual and voice interaction with the Chatbot.

CONCLUSION

By enabling textual and voice interaction between Chatbot and the user, the overall user experience is enhanced. Chatbots have shown the potential to replace the website based implementation of FAQ pages. It is a technology that can allow users to have natural conversations to access content and services. Chatbot typically take the form of a chat client, leveraging natural language processing to conduct a conversation with the user.

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Performance Analysis of Metaheuristics and Hybrid Metaheuristics for the Travel Salesman Problem

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Abstract— A performance analysis of metaheuristics and hybrid metaheuristics for the travel salesman problem is presented. Four single classical metaheuristics (genetic algorithm, memetic algorithm, iterated local search, and simulated annealing) were used. In addition, hybrid variations using nine different heuristic techniques for the local search, the mutation, and the intensification were used. The performance analysis was made using the Friedman test, and for the simulated annealing and local search algorithms statistical evidence was found that hybridization provides a difference in performance, while no evidence was found for the genetic and memetic algorithms. Up to six combinations were found to improve performance, five of them based on local search and one more based on simulated annealing.

Keywords— Metaheuristics; Heuristics; Traveling Salesman Problem; combinatorial optimization; Friedman.

I. INTRODUCTION

Optimization problems involving many finite solutions are of interest in a wide range of fields. This kind of problems are classified as combinatorial optimization (CO), and to find the globally optimal solution it is theoretically possible to enumerate and evaluate each one of the solutions. But this approach becomes intractable rapidly due to the exponential growth of most solution spaces. Metaheuristics allow us to simplify this job since they can find solutions close the optimal in a reasonable time. Metaheuristics evolved because most modern problems are computationally intractable, needing heuristic guidance to find good solutions, but not necessarily the most optimal. Some of the must use techniques include genetic algorithms (GA), memetic algorithm (MA), iterated local search (ILS), and simulated annealing (SA).

The travel salesman problem is a CO problem that has been studied extensively, and it is often used as a test for new optimization algorithms. Heuristic techniques have been tested in different instances of the travel agent algorithm. In this work a Friedman's test analysis was performed to probe if the use of various methods like local search, mutation, and intensification have an impact on performance as compared to the single classical heuristics, the results are ranked according to their performance.

II. THEORETICAL DESCRIPTION

A. Heuristics

A heuristic technique is a process that, for a particular problem, offers a good solution, despite the fact the solution might not be optimal. Generally speaking, these techniques are applied to problems that are difficult to solve, and where it is important to find a quick and easy solution (Zanakis & Evans, 1981).

The heuristics used in this work are: Random Insertion (Twors), Reverse Sequence Mutation (RSM), Thors (Abdoun, Abouchabaka, & Tajani, 2012), OPT (Blazinskias & Misevicius, 2009; Gutin & Punnen, 2007), georeferenced intersection, Centre inverse mutation, Closest insertion and Throas Mutation (Abdoun et al., 2012). These techniques are intended to help in the solution of the travel agent problem. (Bang-Jensen, Gutin, & Yeo, 2004), (Bendall & Margot, 2006), (Talbi, 2009) (Dorigo & Tutzle, 2010), (Cook, 2011).

B. Metaheuristics

Metaheuristics are an iterative search strategy that guides the process over the search space in the hope of finding the optimal solution (Glover, 1986). In general, metaheuristics try to combine basic heuristic methods in higher level frameworks aimed at efficiently and effectively exploring a search space. Metaheuristics allow working at large scales by obtaining a satisfactory solution in a reasonable time. When working with metaheuristics there is no warranty that a global optimal will be found, not even a solution close to the extremes. However, these techniques have gained popularity in the last 20 years since in several applications they have shown efficiency and efficacy in the solution of large complex problems. In metaheuristic design, two opposing criteria must be met: the first one, an efficient exploration of the search space, or diversification; and the second one focusing on a local region where a good solution has been found, or intensification.

C. Genetic Algorithms

The GAs are adaptive exploration methods that can be used in the search for a solution and optimization. The GAs are based on the natural selection that drives the dynamics of

G. Travel Salesman Problem

The travel salesman is a NP-hard problem, and it is one of

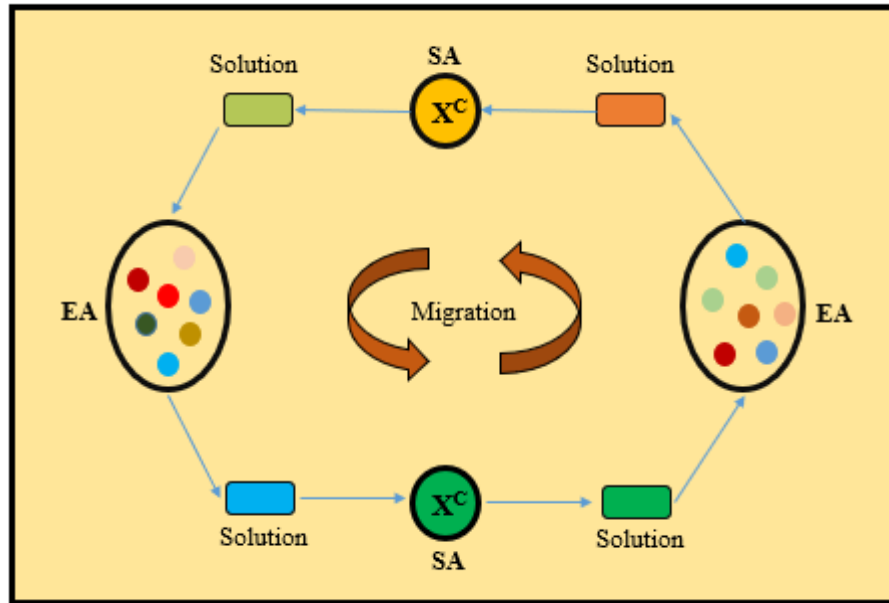


Fig. 1. Multiple EAs and SAs running in parallel.

biological populations. GAs use a probabilistic selection of individuals for the crossover operation. The replacement of the best individuals is generational, which means that the children systematically replace the parents. The crossover operation is based on n-points or steady state, while mutation is performed as the interchange of bits or characteristics.

D. Memetic Algorithms

An MA is composed of two parts: The genetic algorithm and the local search. The local search is a modification of an individual or the total population by copying and perturbing the individual to obtain an individual with a better fitness.

E. Local Iterated Search

The ILS uses an embedded local-search component iteratively restarting it from different promising areas in the search-space. The solutions obtained are better than using random runs without heuristics.

F. Simulated Annealing

This local search algorithm ILS uses an embedded local-search component iteratively restarting it from different promising areas in the search-space. The solutions obtained are better than using random runs without heuristics.

the best-known combinatorial optimization problems. Given n cities and the geographical distances between each one of them, the task is to find the shortest closed tour in which each city is visited exactly once.

H. Friedman's Test

The Friedman's test is a multiple comparison test in which the null hypothesis is that the performance of all the algorithms under comparison is similar. It yields a ranking of the algorithms according to their performance with respect to the control algorithm. To corroborate the ranking a post-hoc procedure is required to identify the differences between the control algorithm and the others.

I. Holm's procedure

The Holm's procedure is used for post-hoc testing, this method is designed for multiple hypothesis testing iteratively accepting or rejecting each one. The procedure begins by ordering the m hypothesis by respective p-value, then each one of the p-values is compared to their alpha values as calculated from:

$$\alpha_i = \frac{\alpha}{(m - i + 1)} \quad (1)$$

where i is the index of the ordered values of p . If the p-value is smaller the hypothesis is rejected, and the rest of the p-values are compared using the current alpha value as threshold. This procedure rejects from H_1 to $H_{(i-1)}$ until $p_i > \alpha_i$

III. NUMERICAL EXPERIMENTS

Numerical experiments were performed under equal conditions, the results are presented in Table 1. A total of 99 combinations of Metaheuristics - Heuristics were analyzed: 9 GAs for mutation, 9 MA for mutation and intensification, 9 SA for local search and a combination of this for a total of 72, were used TSPLIB and are: KROA100, KROB100, KROC100, KROD100 and KROE100.

To evaluate this, Friedman test was used considering $\alpha = 0.01$, $n=5$, $k=99$, and the following hypothesis:

- H_0 = the algorithms offer similar results
- H_a = the combinations offer different results.

Obtaining a p-value of 6.80e-53, thus rejecting H_0 . By using this test, the best combination was SA with RSM heuristic as local search. To corroborate the 10% of the minima values are taken, the results are shown in Table 3.

Table 1. Parameters used for numerical experiments

Parameter	Metaheuristics			
	GA	MA	LIS	SA
Dimension	100	100	100	100
Population	526 ^a	526 ^a	1	1
Stop criteria	100,000 ^b	100,000 ^b	100,000 ^b	100,000 ^b
Experiments	33	33	33	33
Selection	Vasconcelos	Vasconcelos	-	-
Crossover	k-opt ^c	k-opt ^c	-	-
Mutation	1%	1%	-	-
Elitism	5%	5%	-	-
Intensification	-	10 iterations	-	-
Degrees	-	-	-	36
Mk	-	-	-	20

^a. Based on eq. (2), ^b. Function calls, ^c. $k=1$

$$C = 1 + (3.322 * \log_{10}(n)) \quad (2)$$

Using Friedman test using $\alpha = 0.01$, $n=5$, $k=9$ and the hypothesis:

- H_0 = the algorithms offer similar results
- H_a = the combinations offer different results.

IV. RESULTS
Using the Friedman test the medians were compared with $\alpha = 0.01$, $n=5$, $k=99$, and the following hypothesis:

The result is a p-value of 4.41e-06, thus rejecting H_0 . Corroborating that the best combination was SA with RSM heuristic as local search.

- H_0 = the algorithms offer similar results
- H_a = the combinations offer different results.

Table 2 shows the results for the test on whether the use of different heuristics has an impact on performance. The best result has a significant performance improvement with respect to the others and is close to the known optimal value.

- ^a. p-value $< \alpha$
- ^b. El p-value $> \alpha$
- ^c. Combinations with performance close to the control algorithm.

Table 2. Friedman's test results

Parameter	Metaheuristics			
	GA	MA	LIS	SA
P-value	2.18E-02	4.76E-01	5.11E-39	3.61E-06
k	9	9	72	9
Best combination	- ^a	- ^a	RSM-Centre Inverse ^b	RSM ^b

^a Since p-value $> \alpha$, \therefore There is no evidence to reject H_0 . Therefore, a better combination is not determined.

^b Since p-value $< \alpha$, \therefore It is rejected H_0 . Therefore, the test indicates the combination that you consider best.

Table 3. Minimum values (10%)

Combinations	Instances				
	<i>KROA100</i>	<i>KROB100</i>	<i>KROC100</i>	<i>KROD100</i>	<i>KROE100</i>
ILS, Opt3 ^a and RSM ^b (Opt3_RSM)	25623.83415	26503.33992	25296.74211	25382.84543	26163.1529
ILS, Opt2 ^a and RSM ^b (Opt2_RSM)	25165.67006	25770.17034	24593.21096	25288.99249	25924.7774
ILS, Throas ^a and RSM ^b (Throas_RSM)	24903.85386	25510.50853	24505.34143	24737.2369	25607.19984
ILS, RSM ^a and Opt3 ^b (RSM_Opt3)	24960.51781	25682.26716	24849.744	25182.08873	25837.91248
ILS, RSM ^a and Opt2 ^b (RSM_Opt2)	24000.81322	24669.50247	23782.56056	24249.41235	24557.85973
ILS, RSM ^a and Closest Insertion ^b (RSM_ClosestInsertion)	23626.51272	24490.19898	23023.40309	23487.57907	24477.17293
ILS, RSM ^a and Throas ^b (RSM_Throas)	24014.3351	24824.76125	23890.39268	23885.22756	24768.2535
ILS, RSM ^a and Centre Inverse ^b (RSM_CentreInverse)	23301.32146	24217.17605	22766.48955	23371.85614	24101.30297
SA, RSM ^a (Recocido_RSM)	23187.09054	24041.82222	22900.81328	23340.49025	24251.10218
<i>Known optimal</i>	<i>21282</i>	<i>22141</i>	<i>20749</i>	<i>21294</i>	<i>22068</i>

^a Local search

^b Perturbation

Table 4. Holm procedure with RSM

Combinations	Values			
	<i>Statistics z</i>	<i>P-value</i>	<i>α adjusted</i>	<i>H₀ rejected?</i>
Opt3_RSM	4.9057789	9.303E-07	0.00125	yes ^a
Opt2_RSM	4.1311822	3.609E-05	0.0014285	yes ^a
RSM_Opt3	3.7438839	0.0001811	0.0016666	yes ^a
Throas_RSM ^c	2.9692872	0.0029849	0.002	no ^b
RSM_Throas ^c	2.1946905	0.0281858	0.0025	no ^b
RSM_Opt2 ^c	1.8073922	0.0707011	0.0033333	no ^b
RSM_ClosestInsertion ^c	1.0327955	0.3016995	0.005	no ^b
RSM_CentreInverse ^c	0.1290994	0.8972789	0.01	no ^b

a. $p\text{-value} < \alpha$

b. El $p\text{-value} > \alpha$

c. Combinations with performance close to the control algorithm

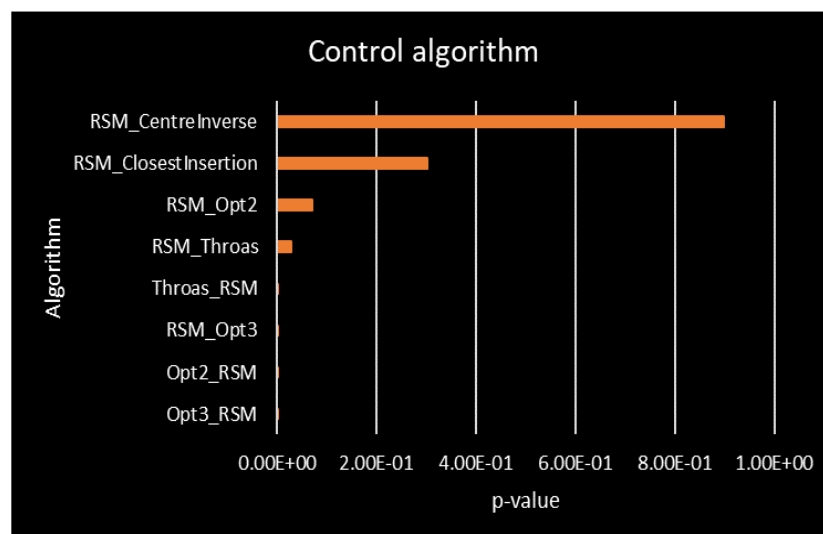


Fig. 2. Graph of the results.

V. CONCLUSIONS

Based on the results obtained, for the GA and MA there is no statistical evidence that applying heuristics for the mutation operator would affect the performance.

On the other hand, according to the Friedman's test, ILS and SA are improved using different heuristics in the local search or in the perturbation.

The SA with RSM in the local search ranked as the best algorithm for the combinations under study.

After the post-hoc procedure it is concluded that there no statistical evidence that 5 combinations produce an effect on the final performance as compared to the control algorithm. The best combinations are presented in Table 4.

As future work it will be found the adequate stop criteria since it is known that this parameter might affect the performance of population-based algorithms.

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Context Sensitive Relatedness Measure of Word Pairs

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Abstract—Semantic similarity and semantic relatedness measure in particular is very important in the current scenario due to the huge demand for natural language processing based applications such as chatbots and information retrieval systems such as knowledge base based FAQ systems. Current approaches generally use similarity measures which does not use the context sensitive relationships between the words. This leads to erroneous similarity predictions and is not of much use in real life applications. This work proposes a novel approach that gives an accurate relatedness measure of any two words in a sentence by taking their context into consideration. This context correction results in a more accurate similarity prediction which results in higher accuracy of information retrieval systems.

Keywords—Information content; semantic similarity; similarity relatedness measur;

I. INTRODUCTION

The core part of any natural language processing applications use some form of semantic similarity computation to find the similarity of the given two words. Semantic similarity is the similarity of two words computed by considering the lexical relations of the two words such as synonyms, hypernyms, and other grammatical relations. Semantic relatedness is the similarity of two words computed by considering the lexical relations of the two words and also functional associations such as frequency of occurrence of the two words in a document or a sentence. In this work, the semantic relatedness measure is computed to find the similarity of two words. Semantic relatedness measures take into account the frequency distribution of words in the document to determine if both the compared documents are semantically similar and related.

Many semantic similarity measures have been proposed in the past to compute the similarity metrics of words. Broadly we could classify the various approaches into two categories, namely, textual based approaches and structure based approaches. Textual based approaches use frequency and distribution semantics to compute the similarity. Structure based approaches use the structure of the knowledge base to compute the semantic similarity; hypernyms and hyponyms is used in word net knowledge-base. They use information content (IC) to compute the semantic similarity and the depth information of concepts to measure the similarity. Lower layers of concepts in a taxonomy are more specific than upper layers, as in, for example, coffee is more specific than liquid or beverage.

A. Motivation

The global market for natural language processing is expected to reach US \$19 billion by 2020, which is due to the increasing demand to process the unstructured data produced by cloud applications. With the advent of cloud applications, corporate IT systems generate large volumes of unstructured data by its users. In order to provide additional intelligence to its users from this data, natural language processing technologies provides the right tools to infer intelligence from these big data. Some of the sectors that use NLP based applications are healthcare, banking, financial services, telecom and legal. In order to cater to these applications, a context driven approach must be adopted to gain an insight on the surrounding environment of the input statements. Current semantic approaches do not take context into consideration. Most of the semantic similarity measures only use the structural information of the data to infer the similarity.

B. Contribution

This work extends on enhancing existing semantic similarity measures. An algorithm to compute the semantic relatedness measure, and which can be used in any application independent of its lexical resource, is proposed. The algorithm is used with word net interface and evaluated against a custom dataset of sentences. The measures computed from the dataset is weighed against the gold standard human judged Miller & Charles (M&C) dataset. The Spearman Correlation of the result is obtained and is compared with the human judged results to measure the accuracy obtained. A high degree accuracy of semantic measures is observed in this work.

The proposed work computes the semantic relatedness of a given pair of words in its context. The work is built in four modules. First the input sentences are preprocessed by tokenizing and bucketing them into verbs and nouns. In the first module, the unique words are aggregated and their frequency count, the number of occurrence of that word in both the sentences, is determined. In the second module the similarity metric of each word pair is computed. Here the similarity computed is among nouns and verbs and they are computed separately. The result of this is an array of objects which depicts the similarity of the word pairs. In the third and the final modules, frequency correction is carried out where the frequency of similar words are incremented. Once the frequency correction is done, the cosine similarity of both the sentences are computed with the corrected frequency table. This gives an accurate measure of the general semantic

relatedness of both the sentences. The obtained cosine similarity measure is the averaged with the obtained similarity metric of each word pair to get the corrected similarity measure.

C. Paper Organization

This paper is organized into three sections. In the first section we elicit the problem definition and explain the exact problem that CSRM tries to solve along with the proposed system architecture and design. In the second section we expound on our algorithm CSRM a novel approach using which semantic relatedness of two documents can be computed. This section consists of the various steps involved in the preprocessing, core and post-processing stages. We clearly illustrate the way in which input data gets transformed to obtain the semantic relatedness measure. In the final section we analyze the performance of algorithm against other standard algorithms to determine the accuracy of our algorithm. We also discuss the other advantages that our algorithm provides over current approaches.

D. Related Work

Many existing works and algorithms try to solve the problem of representing context sensitive grammars of natural languages by representing them mathematically as a frequency distribution of words found in the textual corpus or the structural relation of various words from a structured knowledge base such as Wordnet.

Some approaches use the structural information from public knowledge graphs such as WPATH [1]. Wordnet is a knowledge graph of all words that are grouped into similar groups known as synsets or synonym-sets. Each synset consists of words that are synonyms or similar to each other. These synsets are linked to other synsets that are similar. Concepts on the top of the graph represent more general terms and concepts deeper in the graph denote more specific concepts. Wpath uses the structural information of concepts in Wordnet to infer the semantic similarity of different words. Wpath specifically uses the Information content obtained from knowledge graphs as the distance of two concepts in the concept taxonomy. The least common subsumer of the two concepts are used in determining the similarity of the words.

Other approaches include the corpus approaches that use distribution semantics to compute the similarity of words in a document or corpus. They use various models to represent the semantic meaning of words into vectors. The most notable one is the Word2Vec [2] approach proposed by researchers at Google that takes a large textual corpus to represent it in a vector space. Each unique word in the corpora is assigned vector in the space. Word vectors are positioned in a way that similar words are closer than dissimilar ones.

Corpus based approaches are generally used since they are designed around data in the form of textual corpus that is widely available than data that is structured and organized as knowledge graphs. Also this model can be widely applied to

most of the problems due to the nature of input that does not require structured data.

II. PROBLEM DEFINITION

This section explains the need for a semantic relatedness measure. It also covers the architecture decisions taken and the detailed system architecture of the proposed system.

In any information retrieval system of data mining application, the core of the algorithm is the similarity computation of the various words present in the input with the knowledge base. CSRM aims at solving this problem by computing the similarity of nouns and verbs of the input corpus and the words present in the knowledge base to come up with the most optimum solution.

CSRM uses a combination of distributional semantics (Cosine Similarity) along with structural information Content (Least common subsumer) using the WPATH algorithm. CSRM requires three data sources.

- An input data source (textual corpus)
- A knowledge base which is a predefined data source (also a textual corpus)
- A Knowledge graph which is also a predefined data source internally used by our system. (Structured Knowledge Graph). In our case we use WordNet.

The input data source is input text that is given to the system by the user.

To summarize, this paper takes into account the problem of computing the semantic distance of any two words present in a knowledge graph and other textual corpora. The key contributions of this paper may be concluded as follows.

- We present a new method for computing the semantic relatedness between two textual corpora.
- This method also intelligently uses the context associated with the words by taking the frequency distribution of the word in the knowledge textual corpora.
- We evaluate the presented method against human judged datasets that are the gold standards to compare any semantic algorithms.

A. System Architecture

Our proposed system consists of three modules,

- a) *Input preprocessing module*
- b) *Similarity engine module*
- c) *Output post processing module*

The input preprocessing module is responsible for preprocessing the input textual corpus. The corpus is first lemmatized first to get the simple representation of each word and removed of any tenses associated with it.

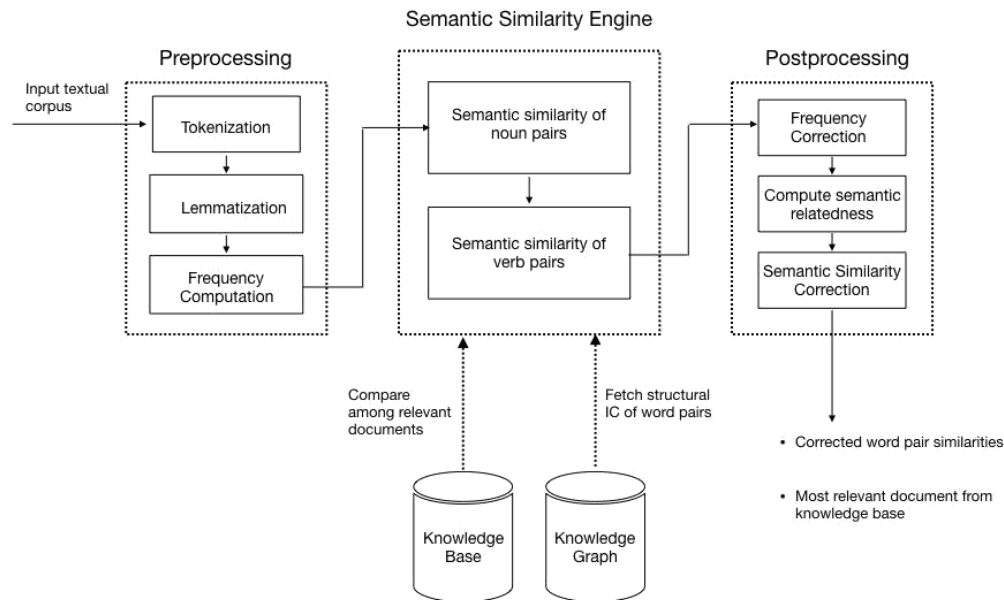


Fig. 1. CSRM architecture

The lemmatized words are then tokenized into individual words and are labelled as nouns or verbs. These nouns and verbs are separated into different lists, as our knowledge graph has structural relations only between similar parts of the speech, and hence this segregation. This step is critical as input to the system needs to be cleaned of any tense association. We may also optionally remove proper nouns and other typographical errors to further clean the input data.

The input preprocessing module also initializes the initial frequency distribution of words present in the input corpus. Frequency distribution of each word is the number of occurrence of that word in the input corpus.

The similarity engine module is the second module in our architecture and is responsible for the computation of the similarity metric between each word pairs. This module is a pluggable module and can be replaced with any other similarity metric algorithm. This is the advantage of our proposed system, which allows and plays well with any semantic similarity algorithms and isn't tied to any specific semantic similarity measures. We demonstrate our work by using WPATH semantic similarity measure. The output of this module would be an array or list of numerical values that denote the similarity measure of the respective input word pairs. It would typically contain two lists, one for nouns and the other for verbs. If no verbs are found in the input sentence only the list pertaining to nouns would be present.

The last module which is the post processing module is responsible for frequency correction. From the previous module we obtain the list of words that are similar. Word pairs with a similarity metric above a specific threshold is considered to have the same meaning. Therefore, word pairs with high similarity metrics are considered same and the frequency count of these word pairs is incremented by one.

Once the frequency correction is done, the cosine similarity of the both the textual corpus is calculated

The post processing module also computes the corrected similarity scores by taking the average of the cosine similarity obtained and the individual word pair similarity score. This final corrected

B. Algorithm

Consists of two strings s1 and s2, where

s1: *A manger fired the worker*

s2: *An employee was terminated from work by boss*

STEP 1: - Tokenization

In this step the sentences are lemmatized and tokenized into verbs and nouns. Words in both sentences post tokenization are bucketed into a dictionary with two keys - nouns and verbs.

```

s1_words = {
    nouns: [manager, worker],
    verbs: [fired]
}
s2_words = {
    nouns: [employee, work, boss],
    verbs: [terminated]
}
    
```

STEP 2: Computing similarity at the macro level

In this step the words obtained from step1 is aggregated to get the frequency distribution of the words in both the sentences. This involves in determining the term frequency which is the frequency of occurrence of words found in both the documents and then determining the cosine similarity between the two vectors that contain the set of words found in the documents.

The term frequency is computed for each sentence by taking the count of occurrence of every unique word found in both the sentences.

TABLE 1. Initialization of term frequency list table

Words	man ager	wor ker	fired	emplo yee	Work	boss	termina ted
tfList_{s1}	1	1	1	0	0	0	0
tfList_{s2}	0	0	0	1	1	1	1

The formula for **term frequency** is as follows:

$tf_x = \text{freq}(w_i)$ where w_i is a unique word found in either sentence A or sentence B, and tf_x is the frequency of occurrence of that word w_i in sentence x.

tfList is the term frequency list which contains the frequency occurrence of all the words found in sentence x. This is computed for each sentence.

$tfList_x = (tf(w_1), tf(w_2), \dots, tf(w_n))$ where w_x is a word found in either sentence x1 or x2 and n is the total number of unique words found in both the sentences x1 and x2.

STEP 3: - Computing similarity at the macro level

This involves in determining the individual context similarity by computing the similarity of word pairs between all the words found in the sentences/documents. This step enables us to get an insight on how similar words in the document are with respect to each other. By bucketing similar words, statistical models perform better. At the micro level we use wpath to compute the similarity between words. The word pairs that have a similarity score greater than 70% are added to the matching matrix

```

for noun n1 in sentence_1_words
  for noun n2 in sentence_2_words
    sim_arr = compute_sim(n1, n2)
  end for
  return max(sim_arr)
end for
for verb v1 in sentence_1_words
  for verb v2 in sentence_2_words

```

$sim_arr = \text{compute_sim}(v1, v2)$

end for

return max(sim_arr)

end for

Matching score is the similarity measure between word pairs. It describes how much meaning similarity do both the words share.

The formula for *matching score* is as follows:

$ms(w_i, w_j) = \text{wpath}(w_i, w_j)$ where ms is the matching score and w_i, w_j are words that are found in sentence S1 or sentence S2.

After matching scores for each word pairs are determined, the matching matrix is computed. Matching matrix is a set of word pairs that have a similarity value greater than 0.7 or 70%. 0.7 is chosen based on best performance as it strikes a balance between over optimism and under optimism.

The formula for determining *matching matrix* is as follows:

$mt = \{(w_x, w_y) \in tfList : ms(w_x, w_y) > 70\%\}$

The matching matrix gives us a set of words that have similar meaning from both the documents.

Once the matching matrix is determined by computing the similarity of all possible word pairs in both the vectors, the term frequencies are updated by taking into consideration the newly obtained values from the matching matrix.

STEP 4: - Term Frequency correction

In this step the frequency of the similar word pairs found in the matching matrix are incremented by 1 and grouped into a single column. This step signifies that different words with the same meaning, are not different but essentially represent the same meaning.

The formula to construct the corrected term frequency list is as follows:

$tfList_{(final)} = \{Y : X_i, X_j \in tfList (X_i + X_j > 0.7 \rightarrow X_i + X_j + 1)\}$

the final tfList contains words with similar meaning (words that have a matching score greater than 0.7) with their frequency weights increased by 1, and also individual words that are not related to other words retaining their original frequency weights.

TABLE 2 . Matched words frequency

Words	manager	Fired/te rminate d	Employee /worker	work	boss
S1	1	2	2	0	1
S2	1	2	2	1	1

After the correction we have two $\text{tfList}_{(\text{finals1})}$, $\text{tfList}_{(\text{finals2})}$ vectors which is the corrected vectors. We then use these corrected vectors to compute the cosine similarity. This leads to a more accurate similarity metric because of the following hypothesis: The cosine similarity is a measure of angle between both the vectors. As the angle ranges from 0 to 90 degrees, $\cos(\text{angle})$ ranges from 1 to 0. Therefore, the more divergent the angle is greater is the dissimilarity. In our approach the corrected bucketing of similar words leads to a reduction in the vector length with also an increase in weights for similar words. This leads to a reduction in the angle, thereby giving a more accurate and higher metric for sentences with different words but similar meaning.

III. EVALUATION

The proposed algorithm is evaluated against the standard M&C dataset. After applying spearman correlation to the set of words present in Miller & Charles data set, the spearman correlation obtained was 0.8. Spearman and Pearson's correlation has been used in other works.

A similarity measure is considered to have a better accuracy if it has a higher correlation score closer to 1.0.

TABLE3. Spearman Correlations with Ground Truth

Method	Spearman Correlation of M&C Dataset
path	0.781
lch	0.781
lin	0.784
jcn	0.775
wpath	0.795
csrm	0.80

In order to evaluate the performance of CSRM, we created sentences having words from the gold standard datasets. We created similar sentences with each word from the word pair present in either sentence. These sentences were then tested with CSRM to determine the accuracy. We computed the spearman correlation of these and found it to be better than WPATH. One of the main reasons for the improvement in accuracy is due to the cosine similarity correction taken up. Without the cosine similarity measure applied to the individual similarity measure, the spearman correlation drops by 0.12, which is a significant drop.

IV. CONCLUSION AND FUTURE WORK

In this work we have suggested and proposed and new state of the art algorithm that can be used in natural language

processing based applications. We first illustrated the shortcomings of the current approaches which was not suitable for real life applications due to the absence of context sensitivity. We then evaluated our algorithm against the standard human datasets and found the results to be phenomenal. Also another advantage of our work is that it could be applied to any semantic similarity metric and is not dependent on any.

In the future we could evaluate if other similarity metrics could perform better and further explore on improving the relatedness measure of the cosine similarity by normalizing and adding weight to certain parts of the speech to emphasize the importance of it.

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Hybrid Artificial Bee Colony Algorithm with Simulated Annealing for Numerical Optimization

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Abstract—The artificial bee colony (ABC) is one of the most powerful swarm intelligence (SI) approaches and it simulates honeybees' foraging behavior. A well-known limitation of ABC is getting trapped at the local optima owing to its exploitation process. On the contrary, one of the effective metaheuristics approaches that is known to avoid such a problem is simulated annealing (SA) because of its effective search mechanism. Therefore, this paper presents a new hybrid algorithm called SA-ABC that exploits the advantages of SA and ABC to improve the performance of ABC. The proposed algorithm was tested on seven numerical benchmark functions, and its performance was compared with the original ABC. The results were promising in that SA-ABC found lower objective values when compared with well-known approaches. Furthermore, SA-ABC outperformed ABC in the majority of the benchmark functions. However, various issues were highlighted in the experiment, and these need to be further investigated in the future.

Index Terms—Artificial Bee Colony, Hybrid Systems, Optimization, Swarm Intelligence, Simulated Annealing

I. INTRODUCTION

In recent years, swarm intelligence (SI), an artificial intelligence approach, has become one of the dominant approaches for solving optimization problems. SI is concerned with the adoption of the collective behavior of animals and social insects such as birds, fish, bees, and ants to develop systems that can solve complex problems [9, 10, 17]. Currently, various SI approaches such as particle swarm optimization (PSO) and ant colony optimization are widely used. Furthermore, one of the most recent SI approaches is ABC, which imitates the behavior of honeybees foraging. This approach is dominantly used by researchers because of its simplicity and robustness. In addition, different versions of bee-colony approaches can be found in the literature and are most likely based on the mating behavior of bees. In fact, ABC was adopted successfully to solve optimization problems in different domains (see Section II). However, one of the well-known limitations of ABC is getting trapped in the local optima, which is most likely owing to its exploration process.

Therefore, the aim of this paper is to fill this gap by proposing a hybrid algorithm by taking the advantages of a powerful metaheuristics approach with simulated annealing (SA). Recently, it was adopted successfully to solve real-world problems. These problems come from numerous domains. Owing

to space limitations, we will highlight only a few of the well-known problems. For instance, various studies were performed to solve the traveling salesman problem (TSP) using SA, including [3] [41] [50]. In fact, it has been adopted to solve one of the most recent versions of the TSP, which is called the multiple maximum scatter traveling salesperson problem [15]. Furthermore, several approaches and techniques adopted SA to solve various transportation problems, including freight transportation systems [36], green transportation [49], and vehicle routing [54]. The majority of these studies presented encouraging results for the adoption of SA in optimization.

The rest of the paper is structured as follows. Section II sheds light on ABC and related studies. In section III, the basic version of ABC is described. Then, SA is defined in section IV. The experimental design and setup are presented in section VI. Experimental results and discussion are presented in section VII. Finally, the paper concludes with highlights on future works and concluding remarks in section VIII.

II. RELATED WORK

In 2005, Dervis Karaboga proposed a new artificial algorithm based on a honeybee swarm called ABC[27]. The honeybee swarm was adopted because it satisfied the two fundamental concepts of SI: self-organization and division of labor. ABC basically comprises three types of bees: employed bees, onlookers, and scouts. The algorithm will be described in more detail in the following sections. Since then, researchers have been investigating ABC from different perspectives such as studying its performance and adopting it to solve real problems. For instance, various studies were performed to investigate the performance of ABC in numerical optimization and compare it to other evolutionary algorithms. Karaboga and Basturk [26] and Karaboga and Basturk [29], for example, compared the performance of ABC with differential evolution (DE) and PSO using 13 benchmark functions. The results demonstrated that ABC found the global minimum in the majority of test functions and was near the global minimum in the others. In addition, ABC outperformed DE and PSO in several test functions. During the same year, the researchers published a similar study that compared ABC with the genetic algorithm (GA), PSO, and particle swarm inspired evolutionary algorithm (PS-EA) for multivariable numerical functions

[28]. Similarly, the results demonstrated that ABC was able to avoid the global minimum and outperformed the other algorithms in several functions. In contrast, Krishnanand et al. [33] carried out a comparative study with five bio-inspired evolutionary algorithms, including ABC. The performance of these algorithms was tested using standard benchmark functions. The results indicated that ABC was not of the best algorithms, although it reached the optimum value in some test functions[33].

Numerous modified ABC versions were introduced in the literature. For instance, TSai et al. [52] claimed that the onlooker bees' movements consider only the relation between an employed bee and the selected one randomly. Therefore, the researchers proposed the adoption of the universal gravitation law in the exploitation process between the onlooker bees and the selected employed one. The proposed algorithm was called the interactive ABC (IABC). It was compared with the original ABC and PSO using five benchmark functions, and the results indicated that (IABC) outperformed the other algorithms for only a specific n value in test functions. Furthermore, Zhang et al. [58] claimed that the convergence of ABC is slow and can be stuck in the local minima easily because of its random mechanism. Therefore, these researchers proposed a modified version of ABC wherein two modifications were applied: 1) combined greedy selection and 2) using sensibility to produce new solutions in onlooker bees instead of using random numbers to calculate probability. To examine the performance of the proposed modifications, they were independently compared to the original ABC, and then combined and again compared to ABC. The results showed that the searching ability was improved in the modified versions of ABC. Likewise, Guo et al. [19] proposed a modification to the search process of ABC to avoid being trapped in local optima by applying the concept of global search, which was inspired by PSO. Previous information of found solutions such as position and nectar amount (fitness value) was employed, and onlooker bees were used instead of neighbor information. The results demonstrated an improved performance for the proposed method over the original ABC and PSO. In fact, various studies were conducted to improve the exploitation process of ABC, including [4] [45].

Parameter selection and tuning are crucial factors in the success of ABC in solving optimization problems. These factors affect its performance. Three parameters are mainly used in ABC: scout limit, maximum cycle number, and the number of food sources. Reference Akay and Karaboga [2] performed several experiments to investigate the effect of these parameters in addition to others such as colony size, and found that the value of these parameters can significantly affect the performance of the algorithm. Specifically, it was observed that the scout limit for a small population is recommended to be relatively small to reduce the number of random solutions. In addition, it was found that initialization ranges do not considerably affect ABC in producing solutions. Population size was also found to affect the behavior and performance of ABC [1][14]. Furthermore, The selection mechanism adopted

in the ABC was found to significantly affect its performance. For instance, Bao and Zeng [7] performed a comparative study among different selection strategies adopted in the ABC such as tournament, rank, and disruptive strategy. The results demonstrated differences in the performances of the algorithms among the three selection strategies and that originally used with ABC. Specifically, the experimental results revealed that the performance of ABC with the three proposed strategies outperformed the original algorithm [7].

ABC in its original or modified form was adopted to solve different optimization problems. Various researchers adopted it to solve multiobjective optimization problems such as [20][60][55], and others used it to solve constrained problems such as [40]. In addition, ABC was used frequently to solve combinatorial optimization and real-world problems, although it was originally designed for numerical optimization. In order to solve such problems, the ABC was mostly modified or hybridized with other evolutionary algorithms or local search methods. For instance, Banharnsakun et al. [5] proposed a hybrid ABC with a Greedy Subtour Crossover to solve the TSP. The purpose of this hybrid was to enhance the exploitation process of the ABC, and the results showed that the proposed method was able to solve the problem. In addition, this method demonstrated an improved performance in terms of precision and computational time when compared with other algorithms. Furthermore, Li et al. [35] proposed a hybrid ABC algorithm in order to solve the well-known job-shop scheduling problem. In this study, an ABC was hybridized with a Pareto archive set to keep track of good solutions during the process of optimization. The results indicated that the proposed algorithm was able to solve the job-shop problem; however, it did so with almost the same performance as other approaches used for comparison in the study. Recently, Sundar et al. [51] proposed a hybrid ABC algorithm to solve an extended version of the same problem, which consists of a no-wait between operations in machine jobs. In this study, an ABC was hybridized with a local search algorithm to find the best neighborhood solutions. The proposed approach was compared with two approaches that reported the best results in the literature, and showed an improved performance. Hybrid ABC algorithms were also used for the optimization of cloud computing in different aspects. For example, Prashanth et al. [44] proposed a hybrid ABC with a cuckoo search to optimize cloud vulnerabilities. By contrast, Zhou and Yao [61] proposed a Leavy-flight-based ABC for solving cloud service compositions and optimal selection problems, which are well-known cloud manufacturing problems. In artificial intelligence, a hybrid ABC was able to successfully optimize the parameters of an adaptive network fuzzy inference system (ANFIS)[7]. In addition, an ABC was successfully hybridized with other approaches to solve real-life problems such as engineering and manufacturing challenges [46][59][6][57]. Table I lists some of the approaches that were hybridized with an ABC, and the problems that these approaches were adopted to solve.

As mentioned earlier, one of the reasons behind

TABLE I: Examples of typical hybrid ABC approaches

Algorithm	Problem	References
bacterial foraging	Numerical optimization	Zhong et al. [60]
Pareto archive set	job shop scheduling	Li et al. [35]
Cuckoo search	Cloud Security	Prashanth et al. [44]
artificial neural network	pavement classification	Banharnsakun [6]
Taguchi method	vehicle structural design	Yildiz [57]
Quantum evolutionary	combinatorial optimization	Duan et al. [16]
Greedy Randomized Adaptive Search Procedure	clustering	Marinakos et al. [38]
particle swarm	Numerical optimization	Shi et al. [48]
genetic algorithms	Permanent Magnet Synchronous Motors	Jatoth and Rajasekhar [23]
tabu search	job shop scheduling	Li et al. [34]
graph node coloring	University Course Scheduling	Oner et al. [42]

TABLE II: Examples of typical hybrid SA approaches

Algorithm	Problem	References
Whale Optimization	feature selection techniques	Mafarja and Mirjalili [37]
Genetic Algorithm	Traveling Salesman Problems, flexible flow shop scheduling, Cloud manufacturing	Xu et al. [56], Dai et al. [13], Hu et al. [22]
Ant colony	Distribution network	Chen et al. [12]
particle swarm optimization	flow shop problem, Wireless Mesh Networks	Meziani et al. [39], Sakamoto et al. [47]
linear programming	Distribution network	Popović et al. [43]
brain storm optimization	continuous optimization	Jia et al. [24]
imperialist competitive algorithms	facility layout problem	Hosseini et al. [21]

hybridization in an ABC is to solve combinatorial optimization problems. Moreover, one of the main drawbacks of the ABC is getting trapped in local optima. Therefore, efforts have been devoted to overcome this limitation by hybridization and modification. From studies described above and by taking a look at the literature, it can be noticed that no significant efforts have been carried out to improve the greedy selection mechanism used in the ABC. We believe this is one of the main factors that contribute to the local optima issue. SA [53] is one of the powerful evolutionary approaches. It takes into consideration the worst candidate solutions during the optimization process. In fact, it was successfully used for solving real-life problems in its original form in studies such as [25][32][8], and was hybridized with other approaches such as [11][56][22][13][37]. Table II lists some of the approaches that were hybridized with SA. To the best of our knowledge, ABC and SA have not yet been hybridized. Therefore, in this paper, a hybrid ABC-and-SA algorithm is proposed.

III. ARTIFICIAL BEE COLONY ALGORITHM

The previous section highlighted the applications of the ABC algorithm and shed light on some studies that adopted it. The ABC is briefly defined and discussed in this section, although it is well described in the literature [30]. As mentioned earlier, the ABC is one of the approaches that mimic the behavior of honeybees. Three types of bees construct the colony of ABC: employed, onlooker, and scout bees [30]. Candidate solutions in an ABC are representations of food sources, and the amount of nectar in each food source is its fitness value. The number of employed bees in the

colony is the same as the food sources, which means that each employed bee is associated with a food source. Similar to other swarm approaches, several parameters need to be adjusted before running an ABC. Most important are the colony size, maximum cycle number, and scout limit [30]. In addition, random candidate solutions are generated during the initialization phase, and their fitness values are calculated. Such solutions are usually generated based on the lower and upper limits of the parameters.

Employed bees, then, try to improve food sources (solutions) by generating new solutions from the neighborhood and computing their fitnesses values. New solutions are generated using equation 1, where v_{ij} is the new solution, x_{ij} and x_{ik} are randomly selected solutions where i is the position of the selected employed bee, $j \in \{1, 2, \dots, D\}$, and $k \in \{1, 2, \dots, N\}$. Here, D is the dimension of the problem, which is the number of parameters in each solution; whereas N is the number of candidate solutions, which is equal to the number of employed and onlooker bees. ϕ_{ij} indicates a random number in the range $[-1, 1]$. Then, new generated solutions are compared with the one initially associated, and a greedy selection mechanism is applied. In greedy selection, if the fitness value of the initial solution is lower than that in the new solution, then it is replaced with the new one.

$$v_{ij} = x_{ij} + \phi_{ij}(x_{ij} - x_{kj}) \quad (1)$$

After completing this process, employed bees share the information of the food sources and their fitness values with the onlooker bees, which choose food sources depending on their fitness values in a probabilistic approach. The

probability of a food source is computed using equation 2, where P_i indicates the probability of the solution and fit_i the fitness value of the selected solution. Onlookers generate a new solution based on the selected one using equation 1. In a similar manner to the employed bees, a greedy selection concept is applied to the selected and current solutions. The scout limit parameter is updated in the two phases (i.e., employed and onlooker bees) throughout the optimization process, where its value is increased if the food source has not improved and is decreased if an improvement occurs.

$$P_i = \frac{fit_i}{\sum_{n=1}^N fit_i} \quad (2)$$

Finally, scout bees will be abundant and replace the food sources that did not improve by onlooker and employed bees. Such food sources are determined using the scout limit parameters, where food sources with parameter values exceeding the predefined limit will be abundant and replaced by a new food source using equation 3. x_i is the solution selected for abundance according to its limit value, and $j \in \{1, 2, \dots, D\}$. All three phases are repeated until the number of iterations reaches the value of the maximum cycle number parameter or if a termination criterion is met.

$$v_{ij} = x_j^{min} + rand[0, 1](x_j^{max} - x_j^{min}) \quad (3)$$

Algorithm 1: Simulated annealing pseudocode

```

Set initial temperature T;
Define cooling function  $\alpha(T) \in [0, T]$ ;
Generate a random solution  $x_0$  for initialization;
while not(termination condition) do
    Generate a candidate solution  $x$ ;
    if  $f(x) < f(x_0)$  then
         $x_0 \leftarrow x$ ;
    else
         $r \leftarrow U[0, 1]$ ;
        if  $r < \exp[f((x_0) - f(x))/T]$  then
             $x_0 \leftarrow x$ ;
        end
    end
     $T \leftarrow \alpha(T)$ ;
end

```

IV. SIMULATED ANNEALING

SA is a metaheuristic artificial algorithm inspired by the concept of annealing solids and the crystallizing behavior of chemical substances [53]. It was first introduced in 1983 by Kirkpatrick et al. [31]. One of the main advantages of SA is its ability to avoid getting trapped in local optima by accepting worse solutions within a certain probability [53] [31]. Several parameters need to be tuned before running SA. Most important is the initial temperature. At the beginning, a

random solution is generated. SA usually starts with a high temperature value, which is gradually reduced throughout the iterations. This is called the cooling process. In each iteration, a new candidate solution from the neighborhood is generated using a predefined method depending on the problem under consideration. The fitness values of candidate solutions should also be computed using a predefined objective function. Better neighborhood solutions (i.e., a higher fitness value) are always accepted. However, if the fitness value of the new solution is less than the best value so far, it is accepted based on a probability factor that is computed based on the difference between the fittingness values of the two solutions. The current temperature value is (equation 4), where $E(s)$ denotes the power of any two solutions, k is the Boltzmann constant, and T is the temperature. This probability is compared with a random number r between 0 and 1. When new solutions are accepted, the probability is greater than r .

$$P(s) = \frac{\exp[-E(s)/(kT)]}{\sum_w \exp[-E(w)/(kT)]} \quad (4)$$

When the algorithm reaches the end, the temperature value becomes low. Consequently, the probability of accepting worse solutions gets smaller. Algorithm 1 shows the pseudocode for SA.

TABLE III: Parameters and notations of SA-ABC

Category	Parameter	Meanings
ABC	Colony size (CS)	number of candidate solutions
	Employed bees	50% of colony size
	Onlooker bees	50% of colony size
	Maximum cycles (C)	Number of iterations
	Dimension (D)	Number of solution parameters
SA	Scout limit	limit to abundance a solution
	Temperature (T)	value for accepting worse solutions
	Cooling rate (K)	mechanism for temperature reduction

V. PROPOSED SA-ABC ALGORITHM

As seen in previous sections, ABC is a powerful optimization approach. However, it is likely to get trapped in local optima, most likely because of the greedy selection mechanism adopted for selecting candidate solutions. SA, on the other hand, is capable of avoiding such a problem by accepting worse solutions within some probability. In this section, we describe a hybrid algorithm called SA-ABC that takes the advantages of the two approaches and combines them. In fact, SA-ABC applies the complete exploration process (employed, onlooker, and scout) of ABC and combines it with the selection methods used in SA, in addition to various modifications. The algorithm starts with the initialization of all parameters needed by ABC such as dimensions, colony sizes, and limits for scout bees. In addition, the temperature and cooling rate are initialized at the beginning and are used to select new candidate solutions during the exploration process. The temperature

Algorithm 2: SA-ABC pseudocode

```

SA (CurrentTemperature, CurrentSolutions, NewSolutions)
while not(termination condition) do
     $p \leftarrow \exp[f((x_0) - f(x))/T]$ ;
    if  $f(NewSolution) > f(CurrentSolution)$  then
        ScoutLimit  $\leftarrow$  0;
        CurrentSolution  $\leftarrow$  NewSolution;
    else
         $r \leftarrow U[0, 1]$ ;
        if  $r < p$  then
            ScoutLimit  $\leftarrow$  0;
            CurrentSolution  $\leftarrow$  NewSolution;
        else
            ScoutLimit ++;
        end
    end
end
/* Parameter initialization */
temperature  $\leftarrow$  initial temperature;
MaxCycles  $\leftarrow$  Maximum Cycle Number;
ScoutLimit  $\leftarrow$  set limit for abundance of solutions;
ColonyZize  $\leftarrow$  set size of colony (number of solutions) Generate random solutions v in Colony
while cycle  $\leq$  MaxCycles do
    /* Employed bee phase */
    for  $i \leq ColonyZize$  do
        Generate new solutions from neighborhood;
         $v_i = x_{ij} + \phi_{ij}(x_{ij} - x_{kj})$  ;
        Evaluate fitness value of v[i];
    end
    SA (temperature, X, V);
    /* Onlooker bee phase */
    while  $t \leq ColonyZize$  do
        /* Select solutions based on the probability of fitness values */
        for  $i = 1 \text{ to } ColonyZize$  do
             $r \leftarrow U[0, 1]$ ;
            if  $r < f(x_i)$  then
                 $x[t] = x[i]$ ;
                break;
            end
        end
        Generate new solutions from neighborhood;
         $v_t = x_{ij} + \phi_{ij}(x_{ij} - x_{kj})$  ;
        Evaluate fitness value of v[i];
        SA (temperature, x[i], v[i]);
    end
    /* Scout bee phase */
    find solution with maximum scout limit  $x \leftarrow \max(x)$ ;
    if  $x > ScoutLimit$  then
        ScoutLimit  $\leftarrow$  0;
        Generate new solutions;
         $v = x_j^{min} + rand[0, 1](x_j^{max} - x_j^{min})$ ;
    end
    temperature  $\leftarrow$  initialTemperature/cycle;
    cycle ++;
end

```

TABLE IV: Seven benchmark functions used in experiment

Function	Formula	Range	
F1	Griewangk	$f(x) = -\prod_{i=1}^n \cos\left(\frac{x_i}{\sqrt{i}}\right) + \sum_{i=1}^n \frac{x_i^2}{4000} + 1$	$-600 \leq x_i \leq 600$
F2	Sphere	$f(x) = \sum_{i=1}^n x_i^2$	$-100 \leq x_i \leq 100$
F3	Rosenbrock	$f(x) = \sum_{i=1}^{n-1} 100(x_{i+1} - x_i^2)^2 + (x_i - 1)^2$	$-30 \leq x_i \leq 30$
F4	Rastrigin	$f(x) = n * 10 + \sum_{i=1}^n (x_i^2 - 10 \cos(2\pi x_i))$	$-5.12 \leq x_i \leq 5.12$
F5	Schwefel	$f(x) = \sum_{i=1}^n -x_i \sin(\sqrt{ x_i })$	$-500 \leq x_i \leq 500$
F6	Ackley	$f(x) = -20 \exp(-0.2 \sqrt{\frac{1}{d} \sum_{i=1}^d x_i^2}) - \exp(\frac{1}{d} \sum_{i=1}^d \cos(2\pi x_i)) + 20 + \exp(1)$	$-30 \leq x_i \leq 30$
F7	Levy	$f(x) = \sin^2(\pi w_1) + \sum_{i=1}^{d-1} (w_i - 1)^2 [1 + 10 \sin^2(\pi w_i + 1)] + (w_d - 1)^2 [1 + \sin^2(2\pi w_d)]$, where $w_i = 1 + \frac{x_i - 1}{4}$	$-10 \leq x_i \leq 10$

parameter is initialized with a large value, and it is reduced throughout the running of the algorithm so that the closer the cycle number to the maximum cycle number, the lower the probability of accepting a worse solution. Table III lists the main parameters used and their meanings. In addition, SA-ABC starts with randomly generated solutions. Then, employed bees generate new solutions in the same way as the original ABC. However, after computing the fitness values of these solutions, the SA method is called with the current temperature and current and new solutions. In contrast to the original ABC, a worse solution can be accepted by employed bees based on a probability p , which is computed based on the current temperature using equation 4. Furthermore, if the new solution is accepted, the abundance limit will be assigned zero, whereas it is increased by 1 if it is not accepted, which will increase its probability to be selected by scout bees for abundance. Algorithm 2 shows the pseudocode of SA-ABC. The onlooker bee phase works the same way as with the employed bees; however, candidate solutions are selected based on their fitness values. Similarly, greedy selection is replaced with SA, where a worse solution can be selected based on the current temperature in a probabilistic manner. Then, solutions that did not improve by the employed and onlooker bees are abandoned by scout bees irrespective of the current temperature. Here, solutions with scout limit values exceeding the value initialized at the beginning of the algorithm are selected for abundance, and a new solution is generated using equation 3. At the end of each cycle, the temperature is reduced. Various cooling mechanisms can be adopted with SA. Inverse linear cooling was adopted here using equation 5.

$$\alpha(T) = T_0/k \quad (5)$$

VI. EXPERIMENT

To evaluate SA-ABC and compare its performance with the original ABC, an experiment was performed using seven well-known benchmark functions. Table IV lists these functions with their ranges. All were used with 20 dimensions (d). To ensure a valid comparison between ABC and SA-ABC, the

TABLE V: Parameter settings

Parameter	Value
Colony size (CS)	10
Maximum cycles (C)	2000
Employed bees (n_o)	50% of colony
Onlookers bees (n_e)	50% of colony
Scout bees (n_s)	1
Scout limit	$n_e * d$

TABLE VI: Best values obtained in literature; values obtained from [28] [18]

Functions	GA	PSO	BA	ABC	DE
F1	1.0139	0.030565	36.55	2.01E-08	5.16
F2	19.90	25.08	64.92	8.66	6.43
F3	7.17	12.59	26.15	7.17	7.06
F4	6.81	7.57	12.03	1.45E-08	7.44
F5	1	6.9	9.75	3.61	5.05
F6	9.924	1.1778E-6	7.32	1.6E-11	4.36

values of the parameters were set the same for all functions in the two algorithms. Table V lists the parameter values used in ABC and SA-ABC. In addition, temperature is one of the main parameters used in SA-ABC but is not required in ABC. Its value was set to 2000.

VII. RESULTS AND DISCUSSION

The two algorithms were run 10 times for each benchmark function, and the best objective value obtained during each run for each algorithm was recorded. The mean, maximum, and minimum were calculated to evaluate and compare the performances of both approaches. Table VII lists the results obtained from the experiment. The best values obtained by well-known approaches in the literature were also recorded for comparison purposes. Table VI lists the best values obtained for six benchmark functions (F1:F2). To perform a valid comparison, all values recorded in Table VI were obtained from functions with 20 variables (i.e., dimension = 20), which is the same number used in our experiment, as mentioned previously. Unfortunately, we were unable to find values for F7 that complied with our experiment.

TABLE VII: Experimental Results

Functions	ABC			SA-ABC		
	Mean	Max	Min	Mean	Max	Min
F1	3.12E-12	1.44E-11	2.22E-16	7.01E-06	3.50E-05	1.11E-16
F2	2.12E-16	3.15E-16	9.97E-17	2.85E-16	4.96E-16	1.00E-17
F3	2.51E+00	6.70E+00	1.02E-01	4.17E-01	1.49E+00	4.83E-02
F4	6.02E-08	2.92E-07	0	2.06E-03	1.93E-02	1.42E-14
F5	-7.32E+02	-3.93E+02	-1.02E+03	-7.62E+02	-2.22E+02	-1.20E+03
F6	2.11E-14	4.35E-14	7.99E-15	1.28E-03	1.06E-02	1.87E-14
F7	-7.32E+02	-3.93E+02	-1.02E+03	3.86E-16	2.15E-16	2.15E-16

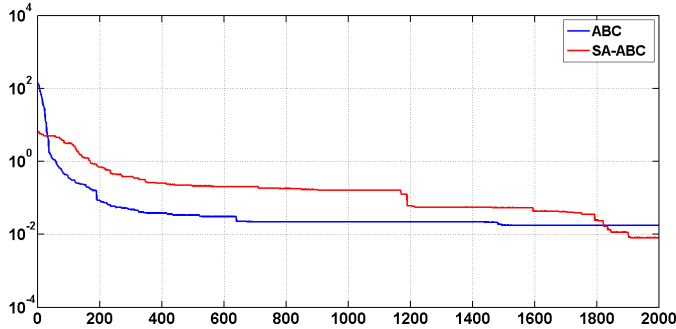


Fig. 1: Convergence of Griewangk function

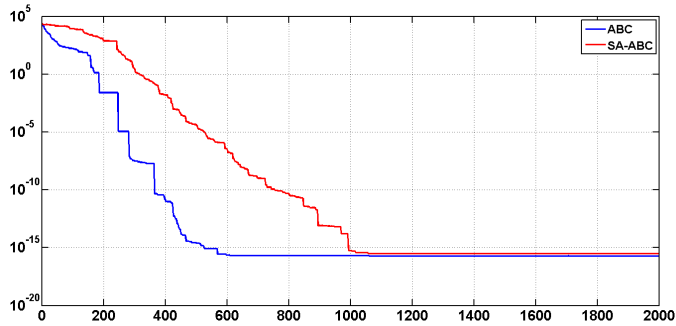


Fig. 2: Convergence of Sphere function

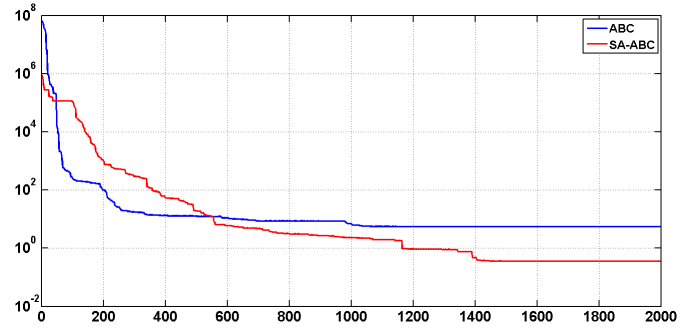


Fig. 3: Convergence of Rosenbrock function

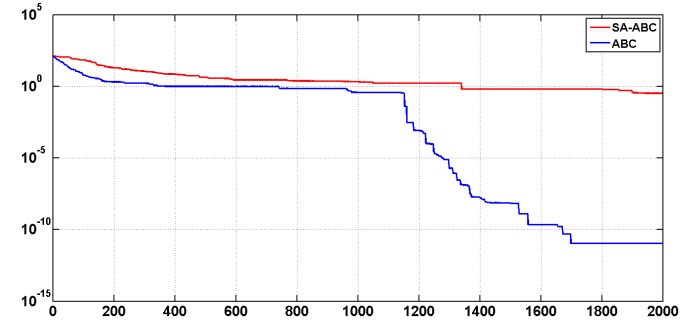


Fig. 4: Convergence of Rastrigin function

In fact, SA-ABC was able to find lower objective values when compared with well-known approaches in the literature such as those in Table VI. Furthermore, it can be noticed from Table VII that SA-ABC obtained smaller objective values than ABC in all functions except for Rastrigin and Ackley. Smaller values are bolded in Table II. Although the mean values of the objective values obtained from ABC were smaller than those for SA-ABC in four functions, it can be noticed that the difference between the maximum and minimum values for ABC in all functions is minor. This confirms that the algorithm stayed within a specific range. By contrast, SA-ABC was able to find better solutions for most of the benchmark functions. Furthermore, the convergence of five functions in the two approaches are presented in Figures 5-2. Owing to space limitations, the convergences of all functions are not presented. In these figures, the best fitness value of each iteration in one run was recorded and plotted. To simplify the understanding of the algorithms' performances, the fitness value is presented on the Y axis in the power of base 10. SA-ABC demonstrated better convergence for the

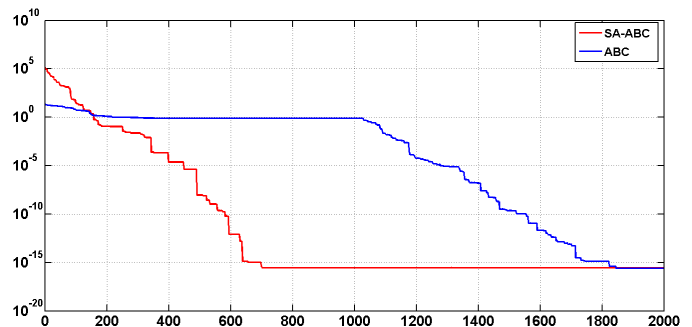


Fig. 5: Convergence of Levy function

majority of functions, whereas ABC outperformed it in only one function (Rastrigin).

VIII. CONCLUSION

In this paper, we proposed a new hybrid algorithm called SA-ABC that uses ABC and SA. The purpose of proposing such an algorithm was to improve the performance of ABC to

avoid getting trapped in local optima. The performance of SA-ABC was tested on seven well-known benchmark functions and was compared with the original ABC. The experimental results were promising and competitive with ABC. In fact, SA-ABC was able to find better solutions for the majority of the benchmark functions. However, further investigation is needed in the future. The effect of the algorithm parameters and function dimensions on the performance of the proposed approach should be investigated. In addition, different design options should be examined, for example, certain types of bees would adopt SA for neighborhood generation. Finally, the performance of SA-ABC would also be investigated on n-variable benchmark functions.

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Detection of Fruits Defects Using Colour Segmentation Technique

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Abstract—In image processing colour segmentation is used to extract features of an object in both special and frequency domains. The objective of this paper is to use colour segmentation technique to identify the defected region of fruits and corresponding percentage of frequency components from its Spectrogram. Here we separate the defective portion of fruit using colour segmentation technique taking four images from four directions to get the appropriate result of 3D images. The percentage of the defective portion is determined using scatterplot of the colours of the image. Next, we apply the similar concept to spectrogram of an image (even applicable in speech signal) to extract the percentages of frequency components of the signal.

Keywords—Scatter plot, mean Euclidian distance, L^*a^*b image, Spectrogram of image and spectral components of speech signal.

I. INTRODUCTION

The value of fruits depends on its quality hence retailers categorize various fruits according to their quality. For example in the European Community, apples have three categories in fresh apple market. Fruits with no defects are in a class called 'extra'. Fruits with little defects are placed in class I. If the defects are too large, these fruits are considered as a Class II category and these types of fruits are rejected as given in [1]. To meet the increasing demand of high-quality products, fruits are graded before being sent to market or for further processing analyzed in [2]. However, manually identification of fruit's defects requires more time as well as cost. This type of process could be done automatically with the help of computer vision systems. To identify the defected region, the first step is to segment the defect.

Image segmentation means separation of an image in different region based on its properties. The goal of segmentation is to simplify and change the description of an image into something that is more suggestive and easier to analyze as explained in [3-4]. The colour is one of the properties which bears information of the image and colour based image segmentation has wide applications. It is convenient to identify different colours in an image on L^*a^*b colour space instead of conventional RGB component.

For automating detecting of fruits defects, many types of research have been done using the computer vision system, but it is still challenging task due to various types of defects, shape, the presence of stem and so on described in [5].

In this paper, we proposed a very efficient and quick segmentation technique based on colour segmentation. Our work carried out several stages; the steps of algorithm is show in next section. In the frequency domain, each colour indicates the different frequency components. Therefore, getting the spectrogram of an image we can separate the sequences of colour components which resembles to different frequency components. That's why it is easy to identify the defected part at a glance as given in [6].

Histogram based image segmentation technique is computationally very efficient when compared to other image segmentation techniques because they usually require only a single pass through the image pixels inspected in [1]. Many colour models are used to represent the colour like RGB, CMY, HSV, HSL; an effort is made to defeat the problems encountered while segmenting an onset by using the colour properties of the image explored in [3]. A region growing algorithm typically starts with some seed pixels in an image and from these, it grows regions by iteratively adding unassigned neighboring pixels that satisfy some homogeneity criterion with the existing region of the seed pixel found in [7]. In paper [8] the authors proposed a new quantization method for HSV colour space to create a colour histogram and a gray histogram for K-means clustering which operates across different dimension in HSV colour space. Image acquisition is the process of acquiring an image from some hardware-based saucers in which the output image can be used for further processing that is analyzed in [9]. The choice of colour space representation could be taken to enhance the performance of processes such as segmentation because of the increment in demand for the colour-driven images as compared to grayscale images inspected in [10-11]. A hybrid method for colour segmentation based on seeded region growing in which the initial seeds are provided by a conservative threshold colour segmentation found in [12]. Creating code elements on the description hexagonal hierarchical structure each island has one or more so-called code elements as explored in [13]. Identifying of fruit defects based on the selection of image region and object offering has been proposed in [14]. A

technique has been proposed which can isolate the healthy parts of olive fruits as well as the actual defected region analyzed in [15]. A computer vision method has been used to identify the grade quality of agricultural products described in [16].

The entire paper is organized as: section II deals with theoretical analysis and algorithm of colour segmentation of fruits, section III provides result based on analysis of section II and chapter IV concludes entire analysis with some future work plan.

II. BASIC THEORY OF L*A*B COLOUR SPACE

It is three axis colour system; where the first axis is L channel or lightness, goes up and down the three-dimensional model and consists of white and black. When $L^* = 0$, it indicates the darkest black and $L^* = 100$ indicates the brightest white found in [10]. The axis a^* indicates where the colour falls along the red to green axis, the negative value of a^* indicates green, and the positive value of a^* indicates magenta. Along b^* axis the colour runs between the blue to yellow. Positive values of b^* represents Yellow and the negative values of b^* indicate Blue. When the channels $a^*=0$ and $b^* = 0$, these represent the true neutral gray. As $L^*a^*b^*$ model is a three-dimensional model, so it can only be represented accurately in a three-dimensional space. The formula for converting digital images from RGB space to the $L^*a^*b^*$ are given below.

$$\begin{bmatrix} L^* = 116f\left(\frac{Y}{Y_n}\right) - 16 \\ a^* = 500\left[f\left(\frac{X}{X_n}\right) - f\left(\frac{Y}{Y_n}\right)\right] \\ b^* = 200\left[f\left(\frac{Y}{Y_n}\right) - f\left(\frac{Z}{Z_n}\right)\right] \end{bmatrix} \quad (1)$$

$$f(x) = \begin{cases} x^{\frac{1}{3}}; & \text{if } x > 0.620 \\ 7.787x + \frac{16}{116}; & \text{Others} \end{cases}$$

;Where X, X_n, Y, Y_n, Z, Z_n are the coordinates of CIEXYZ colour space.

For many digital image manipulation, $L^*a^*b^*$ colour space is more suitable than the RGB colour space since it is device independent.

A. Colour segmentation of image

Generally colour is the most important and influential attribute of fruits quality. Numerous defects of fruits appear as discolouration on surface as mentioned in [2]. Colour based image segmentation means the image will be separated according to colour. The primary aim is to identify different colours in an image by analyzing the $L^*a^*b^*$ colour space. Segmentation of an image is referred to separate the image into a non-overlapping region based on some feature as given in [17]. Colour image segmentation simplifies the vision problem by assuming that objects are coloured distinctively;

where the gross colour differences matters. In our paper, we concentrated on the colour since it is easy to find out defected region according to colour variation.

B. Algorithm

Algorithm for the proposed work is given below.

Step 1. Read the RGB image.

Step 2. Convert the image into $L^*a^*b^*$.

Step 3. Select a region of a particular colour of $L^*a^*b^*$ image.

Step 4. Take the average value of the pixels excluding luminance component. Let the average value is $(u_a, v_a) = z_a$.

Step 5. If the magnitude of i^{th} pixel of the image is $(u_i, v_i) = z_i$. Evaluate the Euclidian distance, $\|z_a - z_i\| = D_i$

Step 6. If $D_i \leq \tau$; (τ is a threshold value of D_i), Then select the pixel, otherwise, ignore it.

Step 7. Repeat step 5 and 6 for all pixels of the image.

Step 8. Now show the image for pixels satisfies steps 5 to 7.

Step 9. Repeat steps 3 to 8 for all the required colours.

Step 10. Draw the scatter plot of all colours on $a - b$ axis.

Step 11. Repeat steps 1 to 10 for another image of same class.

Step 12. Determine to mean Euclidian distance between the pixels of a particular colour (for example purple) on scatter plot. If it is less than the threshold, then the 2nd image is identical with the 1st one.

C. Scatter plot of segmented image

Sometimes instead of x - y , two orthogonal basis functions: $\phi_1(x)$ and $\phi_2(x)$ are used along x and y direction; where the cross-correlation between them are zero i.e. $\langle \phi_1(x), \phi_2(x) \rangle = 0$. The signal component correlated with $\phi_1(x)$ gives abscissa and that of with $\phi_2(x)$ gives ordinate. In colour segmentation, we separate the ' a^* ' and ' b^* ' components of each pixel then plot a^* level values along horizontal axis and b^* level along the vertical axis as found in [18-19]. By counting different colour points from the scatter plot, defected portion is detected.

D. Spectrogram of a signal

The spectrogram is usually represented on a two dimensional plane where the horizontal and vertical axis represents time and frequency; a third dimension indicating the value of a particular frequency at a given time is depicted by the intensity or colour of each point in the image [20-21]. The defected region is usually darker than the original colour of fruits hence the spectrogram will provide distinct region.

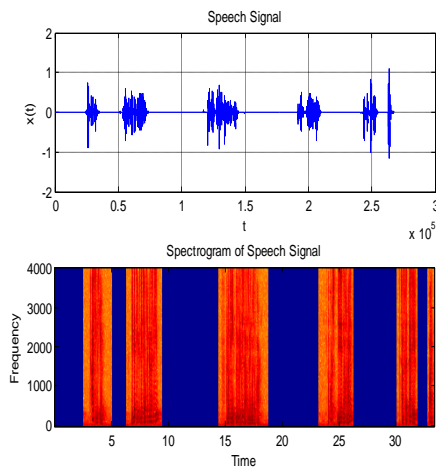


Figure 1. Spectrogram of audio signal

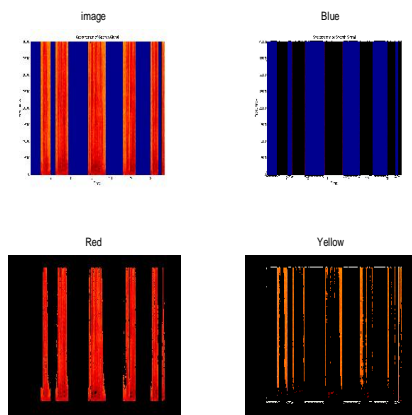


Figure 2. Segmented image of different frequency

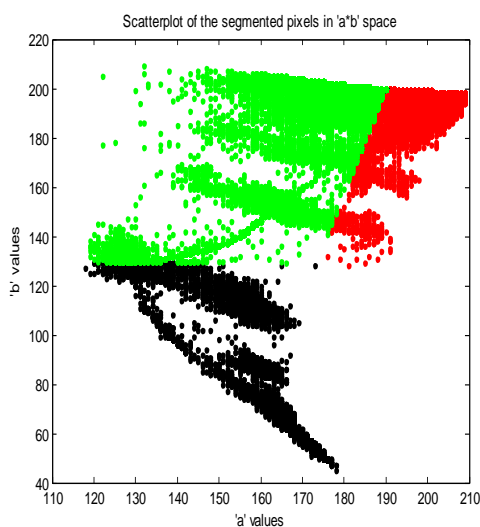


Figure 3. Scatter plot of speech signal

For example a sound wave in time domain varies with amplitude and each segment of the wave possesses different frequency components. Applying simple Fourier transform will provide frequency components but time information will

be lost. Applying short time Fourier transform on each segment will preserve both time and frequency components. The graphical presentation of such phenomenon is actually the spectrogram as shown in fig.1. The colour segmentation and scatter plot of the spectrogram are shown in fig. 2 and 3.

III. RESULT AND DISCUSSION

In this section, we detect the faulty portion of a fruit using colour segmentation technique along with the scatter plot of the different portion of a fruit. In the second technique, we did the similar job using spectrogram of the image. In Fig.4 four images are shown for a particular region of a defective banana. The first image of the figure shows the original image, the second image provides a healthy portion of the image, the third image shows the partially defected portion and the fourth image reveals the fully rotten portion of the image. The Fig.5 shows the scatter plot of the corresponding region of the image. Here we show three colours (green colour represents the faultless portion, the colour of partially defected portion is represented by yellow and red colour represents the fully rotten portion) to acquire the percentage of partially or fully defected portion of the defective fruits.

Next, we take a similar image from four sides of 3-D fruits then measure the percentage of the defective portion from individual scatter plot. Then four scatter plots are summed up to get the illusion of scatter plot of the 3-D image of a defected fruit. The percentage of individual colour are measured from the combined data of four scatter plot. The corresponding figures are shown in Fig. 6-11. Next, we apply similar operation on oranges and apples shown in Fig. 12-27. The entire result of above analysis is shown in table 1.

Next part of the result section, we consider different colours of an image using its spectrogram. In this paper we only provide the guideline of colour segmentation of a spectrogram but detail analysis will be done in future. For simplicity of analysis we show the spectrogram of grayscale image of defective fruit in fig. 28 (a) and (b). In real life situation, we have to separate a and b components of the image first then spectrogram of both component will be taken. The scatter plot of each spectrogram will be count to get the real scenario of the rotten fruit. However, in spectrogram different colour or frequency of an image are separated along frequency axes, hence separation of colour is a little bit easier to compare to the original image. Therefore, we expected to get more accurate result from the spectrogram of an image. This analysis will be performed in details in future and expect to make compares in future. The concept is applicable in biometric identification.

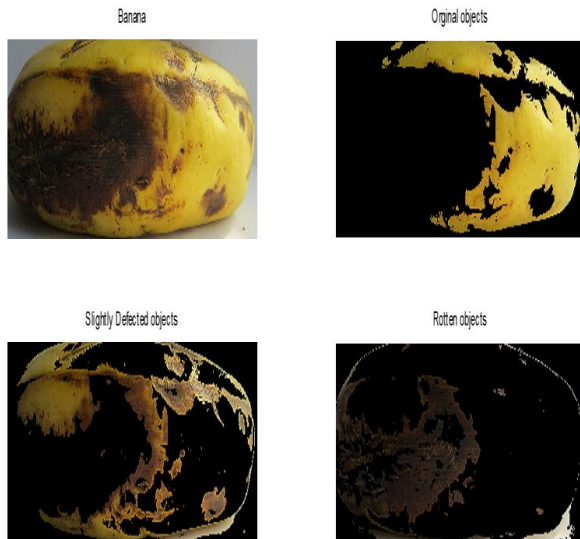


Figure 4. Segmented image of banana of side 1

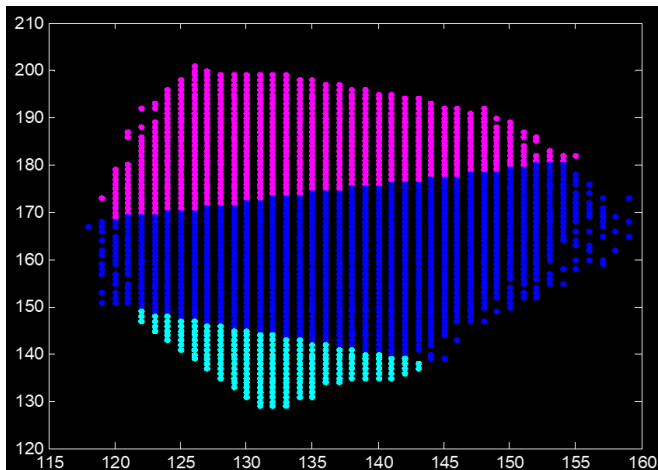


Figure 5: Scatter plot diagram of banana of side 1



Figure 6. Segmented image of banana of side 2

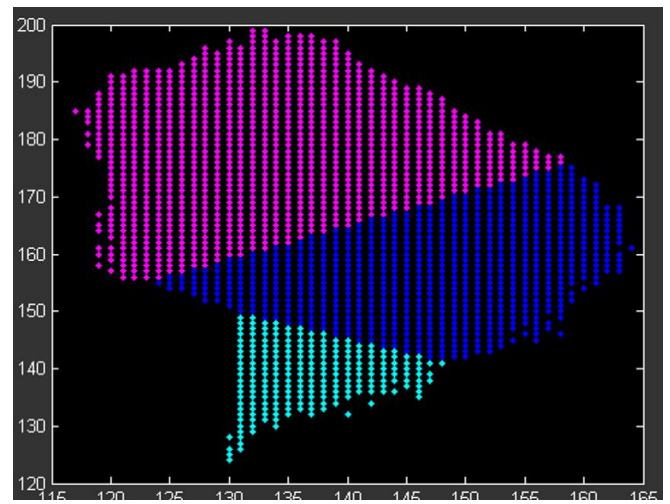


Figure 7. Scatter plot diagram of banana of side 2

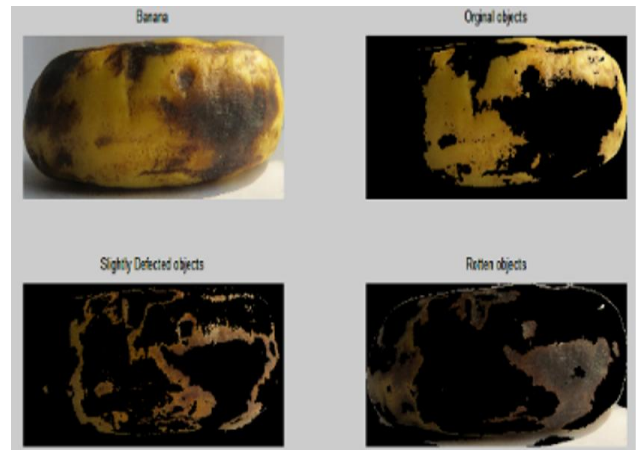


Figure 8. Segmented image of banana of side 3

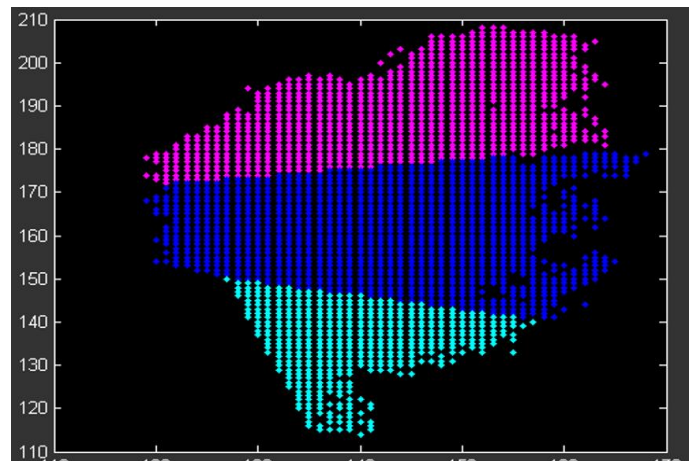


Figure 9. Scatter plot diagram of banana of side 3

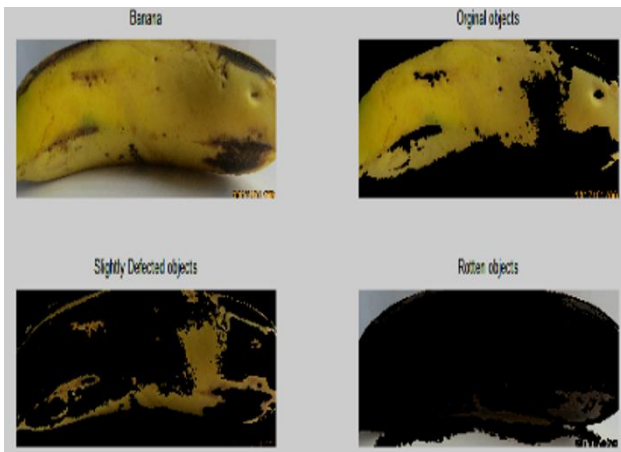


Figure 10. Segmented image of banana of side 4

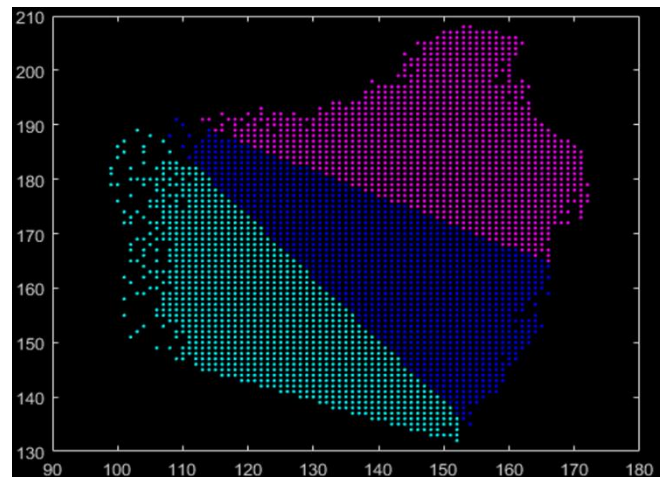


Figure 13. Scatter plot diagram of orange of side 1

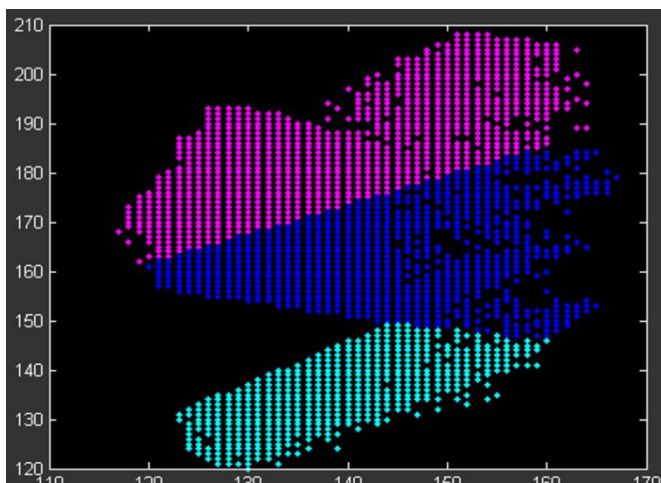


Figure 11. Scatter plot diagram of banana of side 4

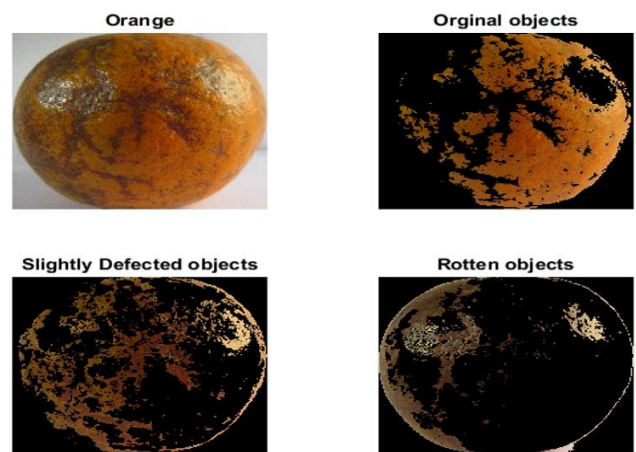


Figure 14. Segmented image of orange of side 2

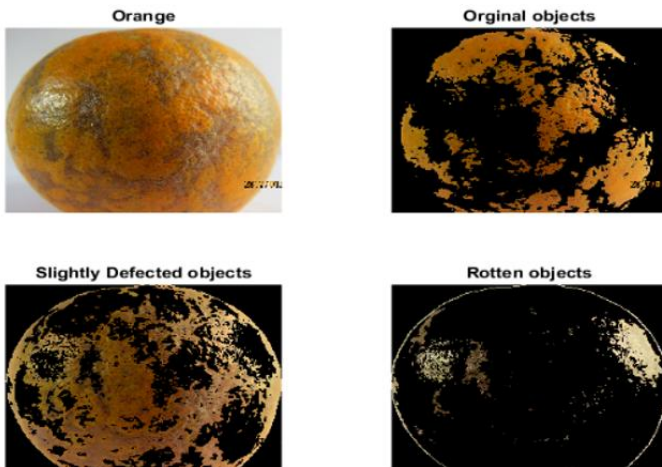


Figure 12. Segmented image of orange of side 1

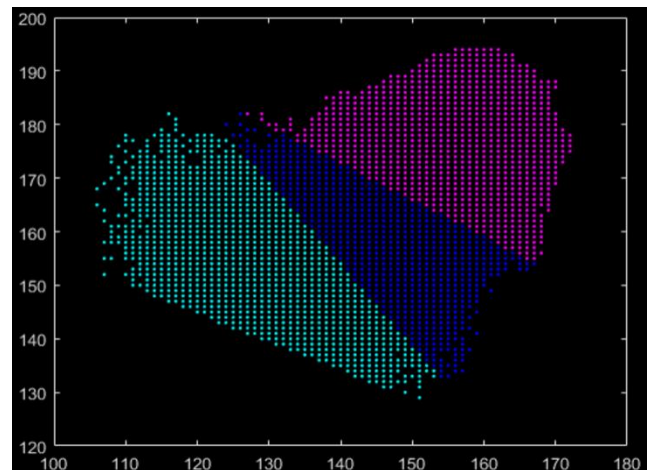


Figure 15. Scatter plot diagram of orange of side 2

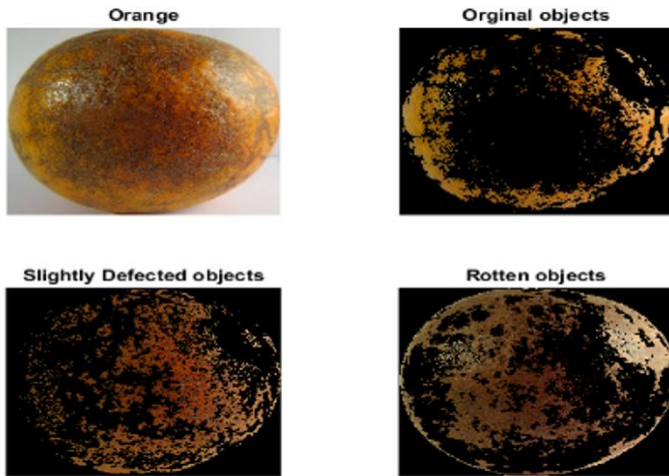


Figure 16. Segmented image of orange of side 3

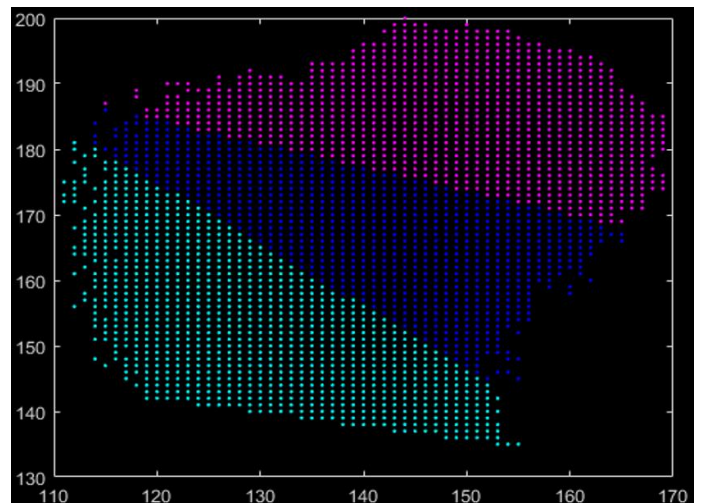


Figure 19. Scatter plot diagram of orange of side 4

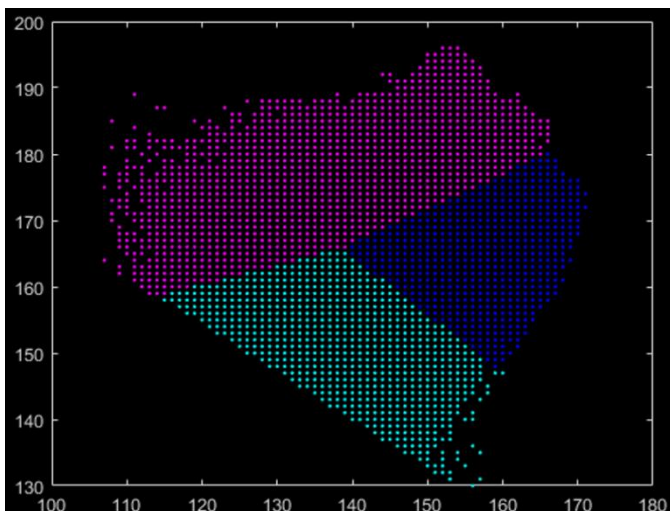


Figure 17. Scatter plot diagram of orange of side 3

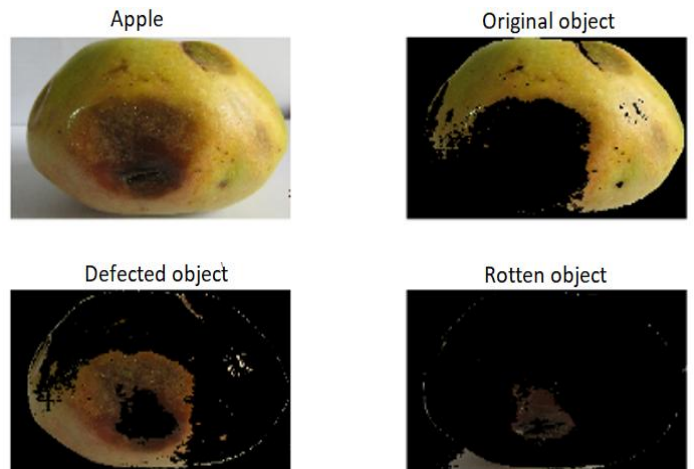


Figure 20. Segmented image of apple of side 1

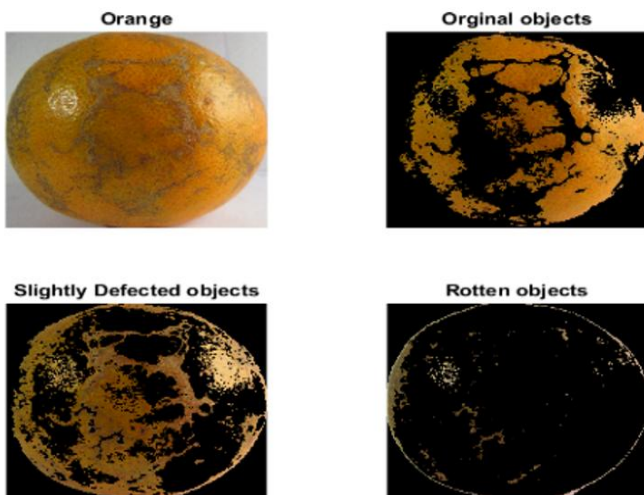


Figure 18. Segmented image of orange of side 4

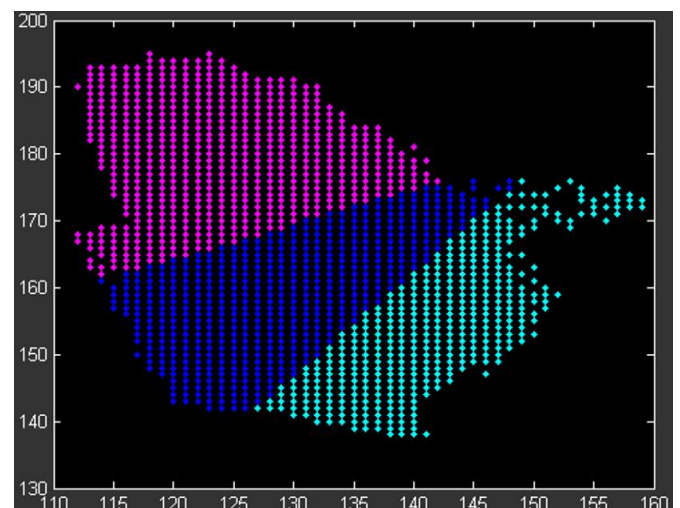


Figure 21. Scatter plot diagram of apple of side 1

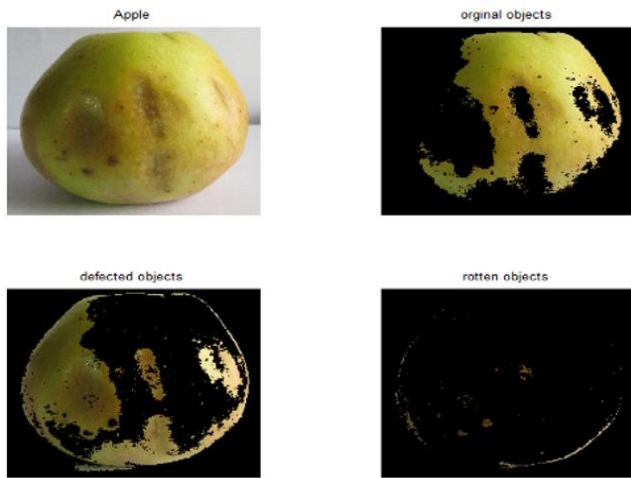


Figure 22. Segmented image of apple of side 2

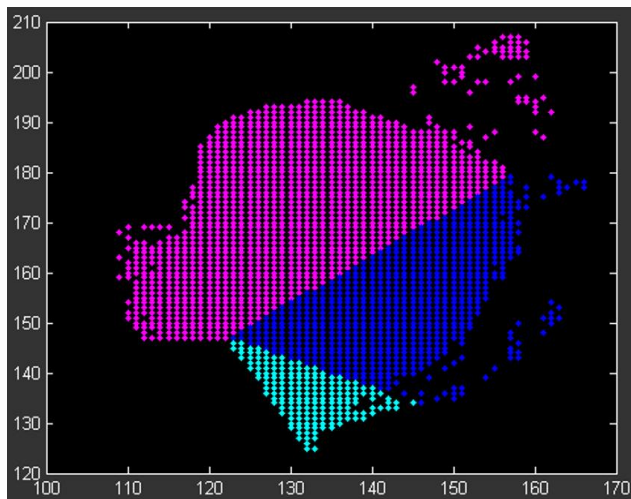


Figure 23. Scatter plot diagram of apple of side 2

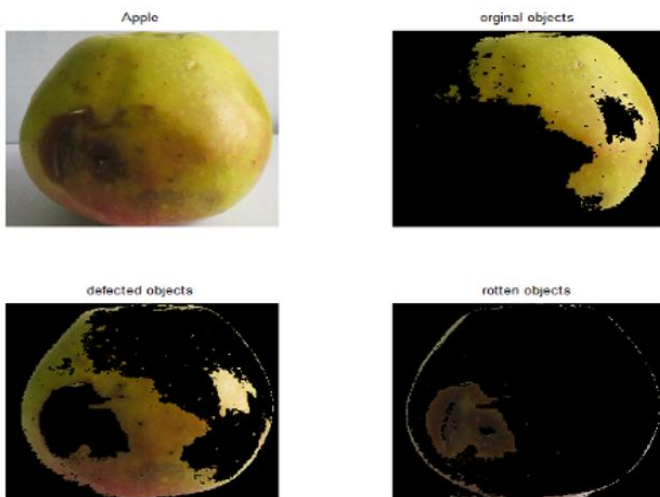


Figure 24. Segmented image of apple of side 3

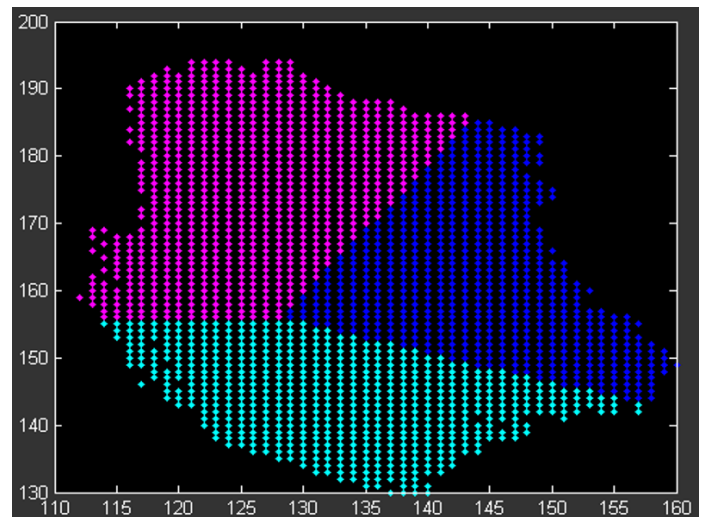


Figure 25. Scatter plot diagram of apple of side 3

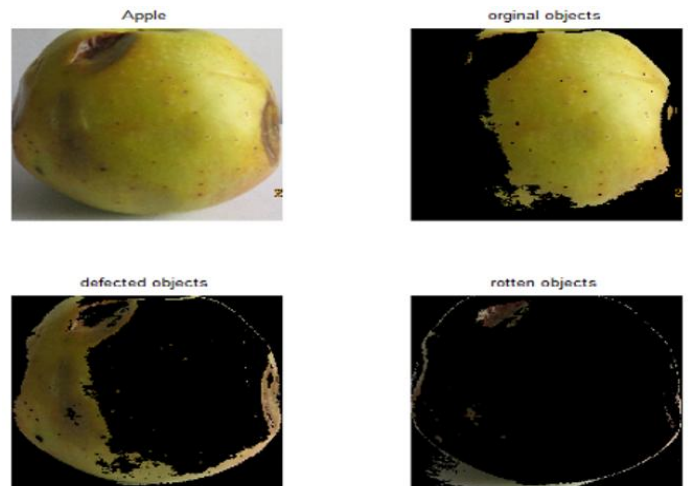


Figure 26. Segmented image of apple of side 4

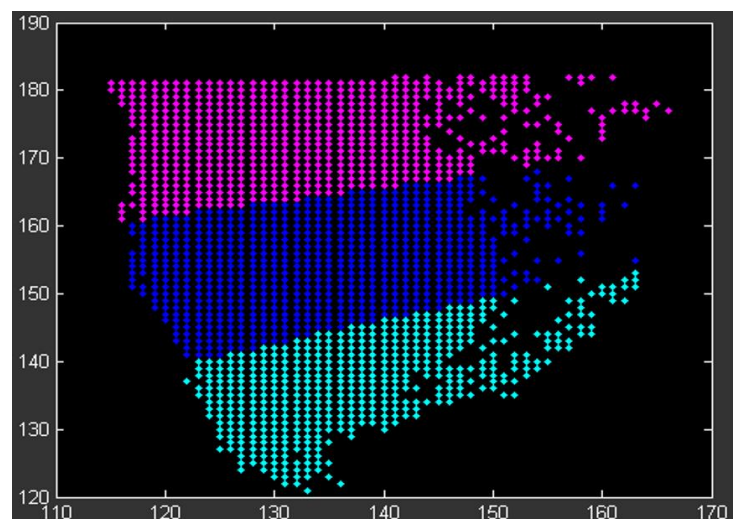


Figure 27. Scatter plot diagram of apple of side 4

Table 1
Percentage of slightly defected and rotten portion of fruits

Fruits Name	Slightly Defected Portion	Rotten Portion
Banana	22%	14%
Orange	42%	20%
Apple	13%	45%

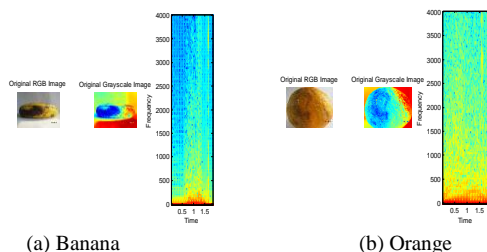


Figure 28. Spectrogram of fruit

IV. CONCLUSION

We took four images from four directions to get the illusion of 3-D image but due to few overlapping region, there is some error in the numerical result. To overcome the situation 3-D image can be used directly but the system model will be very complicated. The concept of the paper can be applied to identify the disease of crop fields and percentage of contamination of field, the condition of the flower of mango, percentage of damage of an object, the condition of soil from satellite map etc. Another application of the paper will be separation of background from the foreground of video frames. Several consecutive frames of a video file can be analyzed, based on the concept of the paper to model the background of the video in identification of a moving object from the foreground.

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A Kernel Approach for Semi-Supervised Clustering Framework for High Dimensional Data

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ABSTRACT

Clustering of high dimensionality data which can be seen in almost all fields these days is becoming very tedious process. The key disadvantage of high dimensional data which we can pen down is curse of dimensionality. As the magnitude of datasets grows the data points become sparse and density of area becomes less making it difficult to cluster that data which further reduces the performance of traditional algorithms used for clustering. Semi-supervised clustering algorithms aim to improve clustering results using limited supervision. The supervision is generally given as pair wise constraints; such constraints are natural for graphs, yet most semi-supervised clustering algorithms are designed for data represented as vectors [2]. In this paper, we unify vector-based and graph-based approaches. We first show that a recently-proposed objective function for semi-supervised clustering based on Hidden Markov Random Fields, with squared Euclidean distance and a certain class of constraint penalty functions, can be expressed as a special case of the global kernel k-means objective [3]. A recent theoretical connection between global kernel k-means and several graph clustering objectives enables us to perform semi-supervised clustering of data. In particular, some methods have been proposed for semi supervised clustering based on pair wise similarity or dissimilarity information. In this paper, we propose a kernel approach for semi supervised clustering and present in detail two special cases of this kernel approach. The semi supervised clustering problem is thus formulated as an optimization problem for kernel learning [4]. An attractive property of the optimization problem is that it is convex and, hence, has no local optima. While a closed-form solution exists for the first special case, the second case is solved using an iterative majorization procedure to estimate the optimal solution asymptotically. Experimental results based on both synthetic and real-world data show that this new kernel approach is promising for semi supervised clustering [5]. We consider the problem of clustering a given dataset into k clusters subject to an additional set of constraints on relative distance comparisons between the data items. The additional constraints are meant to reflect side-information that is not expressed in the feature vectors, directly. Relative comparisons can express structures at finer level of detail than must-link (ML) and cannot-link (CL) constraints that are commonly used for semi-supervised clustering [6]. Relative comparisons are particularly useful in settings where giving an ML or a CL constraint is difficult because the granularity of the true clustering is unknown. Our main contribution is an efficient algorithm for learning a kernel matrix using the log determinant divergence (a variant of the Bregman divergence) subject to a set of relative distance constraints. Given the learned kernel matrix, a clustering can be obtained by any suitable algorithm, such as kernel k-means. We show empirically that kernels found by our algorithm yield clustering's of higher quality than existing approaches that either use ML/CL constraints or a different means to implement the supervision using relative comparisons [7]. The proposed algorithm detects arbitrary shaped clusters in the dataset and also improves the performance of clustering by minimizing the intra-cluster distance and maximizing the

inter-cluster distance which improves the cluster quality.

KEYWORDS: Data Mining, Clustering, Semi-Supervised Clustering, High Dimensional Data, Pairwise Constraints, Kernel K-means, Kernel Matrix, Hidden Markov Random Fields, Similarity.

I. INTRODUCTION

The aim of cluster analysis is to identify either a grouping into a specified number of clusters or a hierarchy of nested partitions. Recently, kernel methods, such as kernel PCA [5], kernel LDA [6] and kernel ICA [7], have been introduced to extract features for recognition. However, kernel parameter selection is difficult. One method is by trial-and-error heuristics, which is easy to implement but not efficient and also causes overfitting problem. The second is using boosting method [8] to learn the combination of kernel functions with different kernel types or different kernel parameters. In [9] one transformed kernel function is discussed, which is good in theory but cannot give an easy and efficient way to obtain the transformation matrix [4]. It is to give an efficient and convenient approach to extract features for high-dimensional data classification problems by generalizing the Gaussian kernel function. We analyze the NN classifier for high-dimensional data classification problems. To obtain better performance, we generalize the Gaussian Kernel to the so-called Data Dependent kernel, which can be easier to calculate compared with the invariant kernel in [9] and obtain better performance than conventional Gaussian kernel and Bayesian Face Matching method [10]. Semi Supervised clustering for classification can be formalized as the problem of inferring a function $f(x)$ from a set of n training samples $x_i \in \mathbb{R}^J$ and their corresponding class labels y_i . The model developed in this paper is aimed at multi-category classification problems. Of particular interest is classification of high dimensional data, where each sample is defined by hundreds or thousands of measurements, usually concurrently obtained? Such data arise in many application domains [2].

The proposed classifier performs classification of high dimensional data without any pre-processing steps to reduce the number of variables. RKHS methods allow for nonlinear generalization of linear classifiers by implicitly mapping the classification problem into a high dimensional feature space where the data is thought to be linearly separable [3]. Kernel methods were first introduced into statistical learning by (1) and later reintroduced by (2) who constructed the Support Vector Machine, a generalization of the optimal hyper plane algorithm for binary classification. Bayesian treatments of this popular deterministic statistical learning method were motivated by the need to overcome the problem of quantifying uncertainty of SVM predictions, as Bayesian framework allows for probabilistic outputs to be obtained from the predictive distribution [5]. Statistical learning models usually have complex structure and contain parameters that need to be tuned, which is often done via cross-validation. In can be argued, see for example (3), that the Bayesian framework is a natural setting for statistical learning algorithms, as decisions on the complexity of structure and parameter settings can be approached by specifying prior distributions, which formalizes the prior beliefs about which inputs are relevant, what a distribution of a parameter is or how smooth a function is [7].

We propose an adaptive Semi-supervised Clustering Kernel Method based on Metric learning (SCKMM) to mitigate the above problems. Specifically, we first construct an objective function from pair wise constraints to automatically estimate the parameter of the Gaussian kernel [3]. Then, we use pair wise constraint-based K-means approach to solve the violation issue of constraints and to cluster the data. Furthermore, we introduce metric learning into nonlinear semi-supervised clustering to improve separability of the data for clustering [6]. Finally, we perform clustering and metric learning simultaneously. Experimental results on a number of real-world data sets validate the effectiveness of

the proposed method. Semi-supervised clustering, which employs both supervised and unsupervised data for clustering, has received significant amount of attention in recent studies on data mining and machine learning communities [8].

Generally, existing methods for semi-supervised clustering can be grouped into two categories. The first category is the linear method including both metric-based and constraint-based approaches, which either aims to guide clustering process towards a more appropriate data partitioning by making use of pair wise instance constraints [2] or initializes cluster centroids by those labelled instances [4]. Specifically, the idea behind the linear constraint-based approach is to modify the objective function of existing unsupervised clustering so as to satisfy pair wise constraints. The metric-based approach learns a distance metric from pair wise constraints, and then utilizes an existing clustering algorithm to learn the similarity between data by using the learned distance metric [1]. In practice, many real-world applications may involve data along with nonlinear patterns, which may not be effectively dealt with by those linear methods. The second one is the nonlinear method or kernel method, which is recently presented and proved powerful. These methods map the data into the feature space implicitly through a mapping induced by a kernel function such that a cluster assignment is performed with the help of the nonlinear boundary in the original space [3].

Clustering a weighted undirected graph by subsequently removing edges with low weights may be hindered by chaining nodes. Like in a single linkage agglomerative clustering a chain of adjacent nodes may connect two distant clusters and thus hinder a splitting of spatially separated clusters [5]. We enhance the elimination of these nodes by applying a pre-processing based on random walks. In the current semi-supervised learning methods, the selection of initial seeds for the clustering algorithm is done randomly by the user, which may cause the data to be selected not from all the clusters; as a result, achieving a clustering model with a high degree of accuracy is not possible [6]. Innovation in this paper is the more accurate way of selecting the initial seeds for the constrained k-means algorithm which results in increased accuracy of the algorithm [7].

II. RELATED WORK

In recent years various partitional cluster algorithms were adapted to make use of this kind of background information either by constraining the search process or by modifying the underlying metric [1]. It has been shown that including background knowledge might improve the accuracy of cluster results, i.e. the computed clusters better match a given classification of the data. Semi-supervised clustering approaches have been shown to outperform their linear competitors [1] for real world tasks. However, existing nonlinear approaches have the following two disadvantages: 1) they do not necessarily improve the separability of the data for clustering; 2) they cannot effectively solve the violation issue of pair wise constraints. In addition, the selection of the kernel parameters is left to manually tuning due to the fact that no sufficient supervision is provided [4]. In practice, it is well-known that the chosen values of the kernel parameters can largely affect the quality of the clustering results [3]. Therefore, it is necessary to overcome the difficulties described above for both conforming to the user's preferences and improving the performance of semi-supervised clustering. The key challenge in improving separability of the data is how we can solve the violation issue of pair wise constraints such that the unlabeled data can still capture the available cluster information [5]. To this end, we present a new adaptive semi-supervised clustering kernel method based on metric learning, called SCKMM, which simultaneously performs clustering and metric learning by studying several important issues.

For the linear method for semi-supervised clustering, [2] proposed the constrained K-means algorithm by adjusting the cluster memberships to be consistent with the pair wise constraints. In [7], the authors presented probabilistic models for semi-supervised clustering where the pair wise constraints are incorporated into the clustering algorithms through the Bayesian priors [4]. It proposed a seeded K-means which tries to get better initial cluster centroids from the labelled instances and restricts the clustering process to be consistent with the constraints. It combined the gradient descent method and the iterative projections together as a convex optimization to learn a Mahalanobis distance for the K-means clustering. It proposed the relevant component analysis algorithm which learned a Mahalanobis distance by making use of the must-link constraints only this method is able to learn individual metrics for each cluster, which permits of different shapes [5]. However, the violation of pair wise constraints is not effectively solved in the clustering process. It provided a way to improve the semi-supervised clustering for high-dimensional data by the constraint-guided feature projection instead of the metric learning [6].

Another approach to the semi-supervised clustering is to cluster the data in terms of the kernel function. Kulis et al. It is to a kernel-based semi-supervised clustering. Instead of adding penalty term for pair wise constraints violated, a reward was given for the satisfaction of the constraints in this method [4]. Analogously, it presented an adaptive kernel learning method for semi-supervised clustering which kernelizes the objective function of Basu's method [6] in the input space. Different from Kulis' method that the setting of the kernel parameter was left to manually tuning, Yan's method optimized the parameter of a Gaussian Kernel iteratively during the clustering process [2]. The above two nonlinear methods, Bayesian method for clustering points using a kernel matrix determinant based measure of similarity between data points. It is nonparametric in that prior mass is assigned to all possible partitions of the data. The proposed method explores this neglected aspect by introducing weights to the views which are learned automatically [3].

From the viewpoint of how the view kernels are combined under our framework, semi supervised multiple kernel learning can also be considered as related work. Kernel k-means is an extension of the standard -means clustering algorithm that identifies nonlinearly separable clusters [2]. In order to overcome the cluster initialization problem associated with this method, we propose the global kernel k-means algorithm, a deterministic and incremental approach to kernel-based clustering [4]. Our method adds one cluster at each stage, through a global search procedure consisting of several executions of kernel -means from suitable initializations [5]. This algorithm does not depend on cluster initialization, identifies nonlinearly separable clusters, and, due to its incremental nature and search procedure, locates near-optimal solutions avoiding poor local minima [6].

Furthermore, two modifications are developed to reduce the computational cost that do not significantly affect the solution quality. The proposed methods are extended to handle a weighted data point, which enables their application to graph partitioning. We experiment with several data sets and the proposed approach compares favourably to kernel k-means with random restarts [1]. Kernel k-means [3] is an extension of the standard k-means algorithm that maps data points from the input space to a feature space through a nonlinear transformation and minimizes the clustering error in feature space. Thus, nonlinearly separated clusters in input space are obtained, overcoming the second limitation of k-means. This algorithm suffers from two serious limitations [2]. First the solution depends heavily on the initial positions of the cluster centres, resulting in poor minima, and second it can only find linearly separable clusters [4]. A simple but very popular workaround for the first limitation is the use of multiple restarts where the centres of the clusters are randomly placed to different initial positions and thus better local minima can be found. The number of restarts and also we are never sure if the initializations tried are good so as to obtain a near optimal minimum [5].

III. KERNEL APPROACH FOR SEMI SUPERVISED CLUSTERING

A key advantage to this approach is that the algorithm assumes a similarity matrix as input. As given in the derivation, the similarity matrix is the matrix of vector inner products (i.e. the Gram matrix), but one can easily generalize this by applying a kernel function on the vector data to form the similarity matrix [1]. The constraint information gives us important clues about the cluster structure, and this information may be incorporated into the initialization step of the algorithm [3]. After this step, we generate initial clusters by using a farthest-first algorithm. We compute the connected components and then choose k of these as the k initial clusters [4].

The farthest first algorithm selects the largest connected component, and then iteratively chooses the cluster farthest away from the currently chosen cluster, where the distance between clusters is measured by the total pair wise distance between the points in these clusters [5]. Once these k initial clusters are chosen, we initialize all points by placing them in their closest cluster. Note that all the distance computations in this procedure can be performed efficiently in kernel space. We must show that each of these objectives can be written as a special case of the weighted kernel k -means objective function [6]. In other words, we explicitly assume that the distance function δ is in fact the Euclidean distance in some unknown vector space. This is equivalent to assume that the evaluators base their distance-comparison decisions on some implicit features, even if they might not be able to quantify these explicitly [8].

IV. KERNEL APPROACH FOR HIGH DIMENSIONAL DATA

The high dimensional data contains more number of attributes, in which some attributes are more important for representing the data points. In order to identify the important attributes in the dataset, the Kernel Principal Component Analysis is used. The kernel principal components are used for defining the kernel function [3]. By using the kernel function [6], i.e., an appropriate non-linear mapping from the original input space to a higher dimensional feature space, clusters that are non-linearly separable in input space can be extracted. The number of clusters is determined automatically using kernel score of all points. The initial clusters are formed using kernel principal components and the kernel scores [2]. The number of clusters and the initial clusters are used as input parameters for kernel clustering algorithm. This algorithm is expected to offer improvement by providing higher inter-cluster distance and lower intra-cluster distance. Since kernel mapping is applied, the algorithm detects arbitrary shaped clusters [4]. After mapping the samples into a higher feature space by a nonlinear mapping function ϕ , the samples in the feature space are observed as Φ . However, once the kernel function is known, we can easily deal with the nonlinear mapping problem by replacing the mapping functions by the kernel functions [7].

V. PROPOSED WORK

V a. KERNEL MULTIVARIATE ANALYSIS (KMVA)

The framework of kernel MVA (kMVA) algorithms is aimed at extracting nonlinear projections while actually working with linear algebra. Let us first consider a function $\phi : \mathbb{R}^d \rightarrow F$ that maps input data into a Hilbert feature space F [1]. The new mapped data set is defined as $\Phi = [\phi(x_1), \dots, \phi(x_l)]^T$, and the features extracted from the input data will now be given by $\Phi^T \Phi = \Phi^T U$, where matrix U is of size $\dim(F) \times n_f$ [2]. The direct application of this idea suffers from serious practical limitations when the dimension of F is very large, which is typically the case. To implement practical kernel MVA

algorithms we need to rewrite the equations in the first half of Table II in terms of inner products in F only [3]. For doing so, we rely on the availability of a kernel matrix $K_x = \Phi\Phi^T$ of dimension $l \times l$, and on the Representer's Theorem [7], which states that the projection vectors can be written as a linear combination of the training samples, i.e, $U = \Phi A$, matrix $A = [\alpha_1, \dots, \alpha_n]^T$. The same σ has been used for all methods, so that features are extracted from the same mapping of the input data [4]. We can see that the non-linear mapping improves class separability.

$$\text{kPCA} : K_x \alpha = \lambda \alpha$$

$$\text{kPLS} : \begin{pmatrix} 0 & K_x Y \\ Y K_x & 0 \end{pmatrix} \begin{pmatrix} \alpha \\ v \end{pmatrix} = \lambda \begin{pmatrix} \alpha \\ v \end{pmatrix}$$

$$\text{kOPLS} : K_x Y Y^T K_x \alpha = \lambda K_x K_x \alpha$$

$$\text{kCCA} : \begin{pmatrix} 0 & K_x Y \\ Y K_x & 0 \end{pmatrix} \begin{pmatrix} \alpha \\ v \end{pmatrix} = \lambda \begin{pmatrix} K_x K_x & 0 \\ 0 & C_y \end{pmatrix} \begin{pmatrix} \alpha \\ v \end{pmatrix}$$

V b. SEMI-SUPERVISED CLUSTERING USING HIDDEN MARKOV RANDOM FIELDS (SSCHMRF)

Semi-supervised clustering is to use a small number of labelled data to aid the clustering of unlabeled data. We propose a novel iterative algorithm to realize semi-supervised clustering considering local constraints [5]. It considers a labelling problem as a Markov process, where each intermediate state stands for a distribution of labels over data points. The goal is to preserve the locality, namely, local constraints as much as possible in the final clusters [6]. Topologically speaking, the clustering process creates a projection, which brings a certain data point from the configuration space to a graph space. It has been proved that the local embedding relations to k nearest neighbours are preserved for such projection [8].

V b1. ALGORITHM FOR SEMI-SUPERVISED CLUSTERING USING HIDDEN MARKOV RANDOM FIELDS (SSCHMRF)

1: Proposed Semi-supervised clustering

Input:

Set of data points $X \leftarrow \{x_1, x_2, \dots, x_N\}$, $x_i \in \mathbb{R}^d$,
Number of clusters C ,
Initially labelled data set $S = \{s_1, \dots, s_C\}$,
Models for each cluster M_c .

Output:

A partitional clustering [16] result $\{X_1, \dots, X_C\}$, where $\bigcup_{c=1}^C X_c = X$;
While # (unclustered points) > 0 and! Stop do
1 Denote the set of labelled data: \hat{X} ;
2 Get set of nearest neighbour's $\Lambda \subset X \setminus \{\hat{X}\}$ of \hat{X} ;
3 for each unlabeled point $x_u \in \Lambda$ do
4 $K_{nnu} \leftarrow k$ -nearest-neighbour (x_u, k, X);
5 each labelled point in K_{nnu} votes for the cluster
6 of x_u using its own label;
7. Update the set for labelled data \hat{X} ;

V b2. PROPERTIES OF SEMI-SUPERVISED CLUSTERING USING HIDDEN MARKOV RANDOM FIELDS (SSCHMRF)

1) The distances definition between any pair of points

- 2) The number of nearest neighbours k that should be considered for k -nearest-neighbour (). The selection of k depends on the expected sparseness of the target dataset.
- 3) A stop condition for the cluster. E.g. when the distance to the nearest unlabeled point is greater than a rational threshold, the cluster model should be considered as stable, hence the clustering should not extend the current cluster further.

V c. MAXIMUM-LIKELIHOOD KERNEL DENSITY ESTIMATION (MLKDE)

KDEs estimate the probability density function of a D dimensional dataset X , consisting of N independent and identically distributed samples $x_1 \dots x_N$ with the sum [9]. This formulation shows that the density estimated with the KDE is non-parametric, since no parametric distribution is imposed on the estimate; instead the estimated distribution is defined by the sum of the kernel functions centred on the data points. KDEs thus require the selection of two design parameters, namely the parametric form of the kernel function and the bandwidth matrix [10]. It has been shown that the efficiencies of kernels with respect to the mean squared error between the true and estimated distribution do not differ significantly and that the choice of kernel function should rather be based on the mathematical properties of the kernel function, since the estimated density function inherits the smoothness properties of the kernel function [11]. Based on the formulation of the leave-one-out ML objective function. We derive a new kernel bandwidth estimator named the minimum leave-one-out entropy (MLE) estimator [12]. (To our knowledge, this is the first attempt where partial derivatives are used to derive variable bandwidths in a closed form solution).

$$p_{\mathbf{H}}(x_i) = \frac{1}{N} \sum_{j=1}^N K_{\mathbf{H}_j}(\mathbf{x}_i - \mathbf{x}_j | \mathbf{H}_j)$$

$$\frac{\partial}{\partial \mathbf{H}_k} (l_{\mathbf{H}}(X)) = \sum_{i=1}^N \frac{\frac{\partial}{\partial \mathbf{H}_k} \left[\frac{1}{N-1} \sum_{j \neq i} K_{\mathbf{H}_j}(\mathbf{x}_i - \mathbf{x}_j | \mathbf{H}_j) \right]}{p_{\mathbf{H}(-i)}(\mathbf{x}_i)}$$

$$\frac{\partial}{\partial \mathbf{H}_k} (l_{MLE}(X)) = \sum_{i=1}^N \frac{\frac{1}{N-1} \frac{\partial}{\partial \mathbf{H}_k} [K_{\mathbf{H}_k}(\mathbf{x}_i - \mathbf{x}_k | \mathbf{H}_k)]}{p_{\mathbf{H}(-i)}(\mathbf{x}_i)}$$

V d. ADAPTIVE-SEMI SUPERVISED-KERNEL-KMEANS (ASSKKM)

The problem of setting kernel's parameters, and of finding in general a proper mapping in feature space, is even more difficult when no labelled data are provided, and all we have available is a set of pair wise constraints [2]. In this paper we utilize the given constraints to derive an optimization criterion to automatically estimate the optimal kernel's parameters. Our approaches integrate the constraints into the clustering objective function, and optimize the kernel's parameters iteratively while discovering the clustering structure [3]. Specifically, we steer the search for optimal parameter values by measuring the amount of must link and cannot-link constraint violations in feature space. Following the method proposed in [4], we scale the penalty terms by the distances of points that violate the constraints, in feature space. That is, for violation of a must-link constraint (x_i, x_j) , the larger the distance between the two points x_i and x_j in feature space, the larger the penalty; for violation of a cannot-link constraint (x_i, x_j) , the smaller the distance between the two points x_i and x_j in feature space, the larger the penalty [5].

$$\begin{aligned}
 J_{obj} = & \sum_{c=1}^k \sum_{\mathbf{x}_i, \mathbf{x}_j \in \pi_c} \frac{K(\mathbf{x}_i, \mathbf{x}_i) + K(\mathbf{x}_j, \mathbf{x}_j) - 2K(\mathbf{x}_i, \mathbf{x}_j)}{2|\pi_c|} \\
 & + \sum_{(\mathbf{x}_i, \mathbf{x}_j) \in ML, l_i \neq l_j} w_{ij} (K(\mathbf{x}_i, \mathbf{x}_i) + K(\mathbf{x}_j, \mathbf{x}_j) - 2K(\mathbf{x}_i, \mathbf{x}_j)) \\
 & + \sum_{(\mathbf{x}_i, \mathbf{x}_j) \in CL, l_i = l_j} \bar{w}_{ij} (K(\mathbf{x}_i', \mathbf{x}_i') + K(\mathbf{x}_j'', \mathbf{x}_j'') - 2K(\mathbf{x}_i', \mathbf{x}_j'')) \\
 & - K(\mathbf{x}_i, \mathbf{x}_i) - K(\mathbf{x}_j, \mathbf{x}_j) + 2K(\mathbf{x}_i, \mathbf{x}_j)
 \end{aligned}$$

V d1. ALGORITHM FOR ADAPTIVE-SEMI SUPERVISED-KERNEL-KMEANS

Input:

- Set of data points $X = \{\mathbf{x}_i\}_{i=1}^N$
- Set of must-link constraints ML
- Set of cannot-link constraints CL
- Number of clusters k
- Constraint violation costs w_{ij} and \bar{w}_{ij}

Output:

- Partition of X into k clusters

Method:

1. Initialize clusters $\{\pi(0)_c\}_{c=1}^k$ using the given constraints; set $t = 0$.
2. Repeat Step3 - Step6 until convergence.
3. E-step: Assign each data point \mathbf{x}_i to a cluster $\pi(t)_c$ so that $J_{\text{kernel-obj}}$ is minimized.
4. M-step (1): Re-compute $B(t)_c$, for $c=1, 2, \dots, k$.
5. M-step (2): Optimize the kernel parameter σ using gradient descent according to the rule: $\sigma(\text{new}) = \sigma(\text{old}) - \rho \partial J_{\text{kernel-obj}} / \partial \sigma$.
6. Increment t by 1.

V e. GLOBAL KERNEL K-MEANS (GKKM)

In this paper we propose the global kernel k-means algorithm for minimizing the clustering error in feature space, defined. Our method builds on the ideas of the global k-means and kernel k-means algorithms [6]. Global kernel kmeans maps the dataset points from input space to a higher dimensional feature space with the help of a kernel matrix as kernel k-means does. In this way nonlinearly separable clusters are found in input space [7]. Also global kernel k-means finds near optimal solutions to the M -clustering problem by incrementally and deterministically adding a new cluster centre at each stage and by applying kernel kmeans as a local search procedure instead of initializing all M clusters at the beginning of the execution [8]. Thus the problems of initializing the cluster centres and getting trapped in poor local minima are also avoided. In a nutshell global kernel k-means combines the advantages of both global kmeans (near optimal solutions) and kernel k-means (clustering in feature space).

$$\begin{aligned}
 b_k^n &= \sum_{i=1}^N \max(d_{k-1}^i - \|\phi(\mathbf{x}_n) - \phi(\mathbf{x}_i)\|^2, 0) \\
 \text{where } \|\phi(\mathbf{x}_n) - \phi(\mathbf{x}_i)\|^2 &= K_{nn} + K_{ii} - 2K_{ni}
 \end{aligned}$$

V e1. ALGORITHM FOR GLOBAL KERNEL K-MEANS (GKKM)

Input: Kernel matrix K , number of clusters M
Output: Final clusters C_1, C_2, \dots, C_M
// There is no need to solve for one cluster as the solution
is trivial and optimal. $C_1^* = X$
1: for all k -clustering problems $k=2$ to M do
2: for all points $x_n, n = 1, \dots, N$ do // suppose $x_n \in C_r^*$
3: Run Kernel k -Means with:
 input $(K, k, C_1^*, \dots, C_r^* = C_r^* -$
 $\{x_n\}, \dots, C_{k-1}^*, C_k = \{x_n\})$
 output $(C_1^n, \dots, C_k^n, E_k^n)$
4: end for
5: Find $E_k^* = \min_n (E_k^n)$ and set (C_1^*, \dots, C_k^*) to the
Partitioning corresponding to E_k^*
//This is the solution with k clusters
6: end for
7: return $C_1 = C_1^*, \dots, C_M = C_M^*$ as output of the algorithm

V f. FAST GLOBAL KERNEL K –MEANS (FGKKM)

The fast global kernel k -means algorithm is a simple method for lowering the complexity of the original algorithm. We significantly reduce the complexity by overcoming the need to execute kernel -means times when solving the k -clustering problem given the solution for the k -clustering problem [9]. Specifically, kernel -means is employed only once and the k th cluster is initialized to include the point that guarantees the greatest reduction in clustering error. The above upper bound is derived from the following arguments [10]. First, when the k th cluster is initialized to include point. Second, since kernel k -means converges monotonically, we can be sure that the final error will never exceed our bound. When using this variant of the global kernel k -means algorithm to solve the M -clustering problem, we must execute kernel k -means M times instead of MN times [11]. In general, this reduction in complexity comes at the cost of finding solutions with higher clustering error than the original algorithm. However, as our experiments indicate, in several problems, the performance of the fast version is comparable to that of global kernel k -means, which makes it a good fast alternative [12].

$$\begin{aligned}
 L(\{q_j\}_{j=1}^N; \mathcal{X}) &= \frac{1}{N} \sum_{i=1}^N \log \left[\sum_{j=1}^N q_j f_j(\mathbf{x}_i) \right] \\
 &= \frac{1}{N} \sum_{i=1}^N \log \left[\sum_{j=1}^N q_j e^{-\beta d_{\mathcal{X}}(\mathbf{x}_i, \mathbf{x}_j)} \right] \\
 &\quad + \text{const.}
 \end{aligned}$$

V g. WEIGHTED KERNEL K-MEANS (WKKM)

If we associate a positive weight with each data point the weighted kernel k-means algorithm is derived [5]. The weights play a crucial role in proving an equivalence of clustering to graph partitioning, which is the reason we are interested in this version of kernel k-means. Again, suppose we want to solve the M-clustering problem [2]. The objective function is expressed as follows, where w_i is the weight associated with data point. Algorithm can be applied with the slightest modification to get the weighted global kernel k-means algorithm. Specifically, we must include on the input the weights and run weighted kernel k-means instead of kernel k-means [3]. All other steps remain the same. The centre of the cluster in feature space is the weighted average of the points that belong to the cluster [4]. Once again, we can take advantage of the kernel trick and calculate the squared Euclidean distances.

$$\|\phi(\mathbf{x}_i) - \mathbf{m}_k\|^2 = K_{ii} - \frac{2 \sum_{j=1}^N I(\mathbf{x}_j \in C_k) w_j K_{ij}}{\sum_{j=1}^N I(\mathbf{x}_j \in C_k) w_j} + \frac{\sum_{j=1}^N \sum_{l=1}^N I(\mathbf{x}_j \in C_k) I(\mathbf{x}_l \in C_k) w_j w_l K_{jl}}{\sum_{j=1}^N \sum_{l=1}^N I(\mathbf{x}_j \in C_k) I(\mathbf{x}_l \in C_k) w_j w_l}.$$

VI. EXPERIMENTS

In this section, we empirically demonstrate that our proposed semi-supervised clustering for kernel approach is both efficient and effective.

VII a. DATASETS

The data sets used in our experiments include six UCI data sets¹. Here is some basic information of those data sets. Table 5 summarizes the basic information of those data sets.

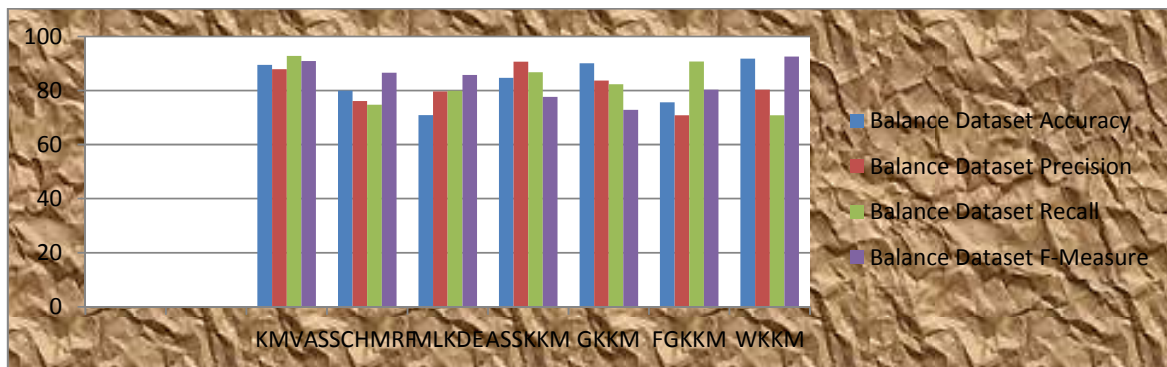
- Balance. This data set was generated to model psychological experimental results. There are totally 625 examples that can be classified as having the balance scale tip to the right, tip to the left, or be balanced.
- Iris. This data set contains 3 classes of 50 instances each, where each class refers to a type of iris plant.
- Ionosphere. It is a collection of the radar signals belonging to two classes. The data set contains 351 objects in total, which are all 34-dimensional.
- Soybean. It is collected from the Michalski's famous soybean disease databases, which contains 562 instances from 19 classes.

Datasets	Size	Classes	Dimensions
Balance	625	3	4
Iris	150	3	4
Ionosphere	351	2	34
Soybean	562	19	35

VIII. EXPERIMENTAL RESULTS

VIII a. BALANCE DATASET RESULTS

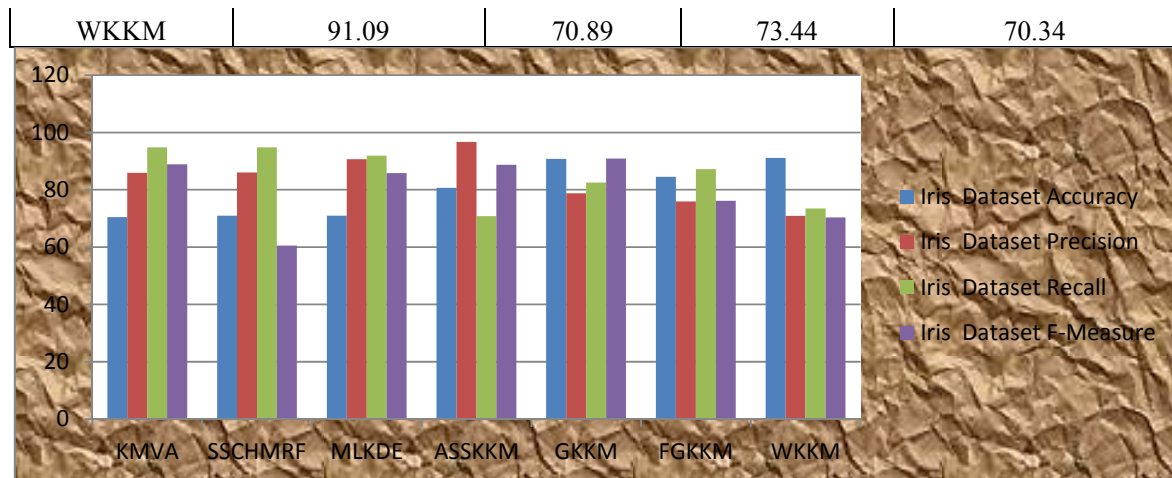
Balance Dataset				
Algorithm	Accuracy	Precision	Recall	F-Measure
KMVA	89.45	87.91	92.77	90.89
SSCHMRF	79.91	76.08	74.78	86.56
MLKDE	70.92	79.67	79.89	85.78
ASSKKM	84.67	90.67	86.78	77.67
GKKM	90.07	83.66	82.33	72.88
FGKKM	75.66	70.89	90.75	80.34
WKKM	91.78	80.34	70.89	92.55



The above graph shows that performance of Balance dataset. The Accuracy of WKKM algorithm is 91.78 which is higher when compare to other six (KMVA, SSCHMRF, MLKDE, ASSKKM, GKKM, FGKKM) algorithms. The Precision of ASSKKM algorithm is 90.67 which is higher when compare to other six (KMVA, SSCHMRF, MLKDE, WKKM, GKKM, FGKKM) algorithms. The Recall of KMVA algorithm is 92.77 which is higher when compare to other six (WKKM, SSCHMRF, MLKDE, ASSKKM, GKKM, FGKKM) algorithms. The F-Measure of WKKM algorithm is 92.55 which is higher when compare to other six (KMVA, SSCHMRF, MLKDE, ASSKKM, GKKM, FGKKM) algorithms.

VIII b. IRIS DATASET RESULTS

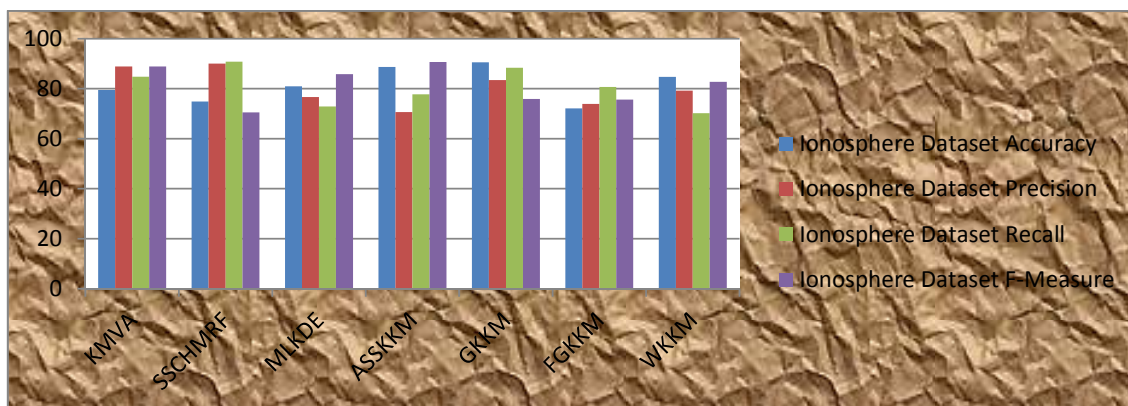
Iris Dataset				
Algorithm	Accuracy	Precision	Recall	F-Measure
KMVA	70.45	85.91	94.79	88.89
SSCHMRF	70.91	86.08	94.78	60.56
MLKDE	70.92	90.67	91.89	85.78
ASSKKM	80.67	96.67	70.78	88.67
GKKM	90.78	78.76	82.54	90.89
FGKKM	84.56	75.9	87.23	76.12



The above graph shows that performance of Iris dataset. The Accuracy of WKKM algorithm is 91.09 which is higher when compare to other six (KMVA, SSCHMRF, MLKDE, ASSKKM, GKMM, FGKKM) algorithms. The Precision of ASSKKM algorithm is 96.67 which is higher when compare to other six (KMVA, SSCHMRF, MLKDE, WKKM, GKMM, FGKKM) algorithms. The Recall of KMVA algorithm is 94.78 which is higher when compare to other six (WKKM, SSCHMRF, MLKDE, ASSKKM, GKMM, FGKKM) algorithms. The F-Measure of GKMM algorithm is 90.89 which is higher when compare to other six (KMVA, SSCHMRF, MLKDE, ASSKKM, WKKM, FGKKM) algorithms.

VIII c. IONOSPHERE DATASET RESULTS

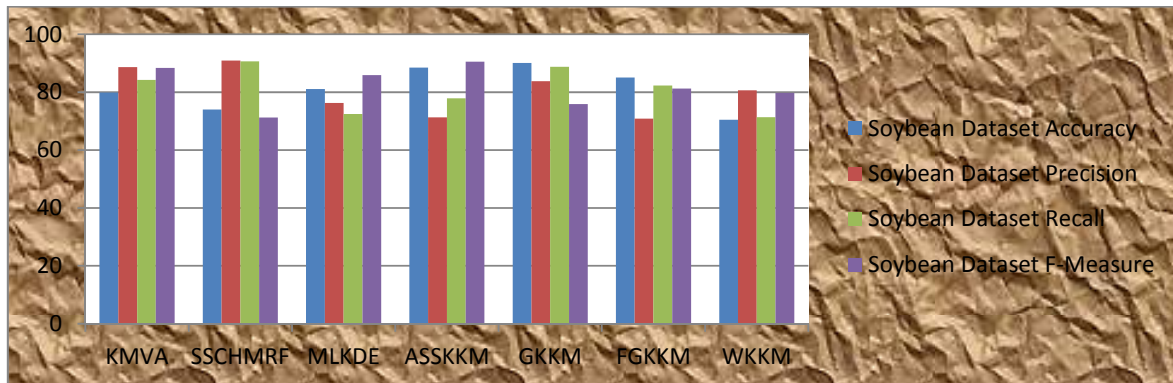
Ionosphere Dataset				
Algorithm	Accuracy	Precision	Recall	F-Measure
KMVA	79.45	88.91	84.77	88.89
SSCHMRF	74.91	90.08	90.78	70.56
MLKDE	80.98	76.67	72.89	85.78
ASSKKM	88.67	70.67	77.78	90.67
GKMM	90.56	83.45	88.34	75.89
FGKKM	72.12	73.9	80.67	75.66
WKKM	84.67	79.23	70.21	82.78



The above graph shows that performance of Ionosphere dataset. The Accuracy of GKMM algorithm is 90.56 which is higher when compare to other six (KMVA, SSCHMRF, MLKDE, ASSKKM, WKMM, FGKKM) algorithms. The Precision of SSCHMRF algorithm is 90.08 which is higher when compare to other six (KMVA, WKMM, MLKDE, ASSKKM, GKMM, FGKKM) algorithms. The Recall of SSCHMRF algorithm is 90.78 which is higher when compare to other six (KMVA, WKMM, MLKDE, ASSKKM, GKMM, FGKKM) algorithms. The F-Measure of ASSKKM algorithm is 90.67 which is higher when compare to other six (KMVA, SSCHMRF, MLKDE, WKMM, GKMM, FGKKM) algorithms.

VIII d. SOYBEAN DATASET RESULTS

Soybean Dataset				
Algorithm	Accuracy	Precision	Recall	F-Measure
KMVA	79.89	88.65	84.23	88.34
SSCHMRF	74.03	90.89	90.67	71.23
MLKDE	81.08	76.32	72.45	85.9
ASSKKM	88.54	71.32	77.89	90.56
GKKM	90.08	83.78	88.78	75.9
FGKKM	85.09	70.89	82.33	81.23
WKMM	70.45	80.67	71.33	79.78



The above graph shows that performance of Soybean dataset. The Accuracy of GKMM algorithm is 90.08 which is higher when compare to other six (KMVA, WKMM, MLKDE, ASSKKM, WKMM, FGKKM) algorithms. The Precision of SSCHMRF algorithm is 90.89 which is higher when compare to other six (KMVA, WKMM, MLKDE, ASSKKM, GKMM, FGKKM) algorithms. The Recall of SSCHMRF algorithm is 90.67 which is higher when compare to other six (KMVA, WKMM, MLKDE, ASSKKM, GKMM, FGKKM) algorithms. The F-Measure of ASSKKM algorithm is 90.56 which is higher when compare to other six (KMVA, WKMM, MLKDE, SSCHMRF, GKMM, FGKKM) algorithms.

IX. CONCLUSION

We have shown that none of the ML estimators investigated performed optimally on all tasks, and based on theoretical motivations confirmed with empirical results it is clear that the optimal estimator depends on the degree of scale variation between features and the degree of changes in scale variation with features [2]. The results show that the full covariance ML-KBE and global MLE estimators (which estimate an identical full and diagonal covariance matrix respectively for each kernel)

performed optimally on three of the four datasets investigated, while the MLE estimator (which estimates a unique bandwidth for each kernel) performed optimally on only one dataset [3]. This is an interesting case of the bias-variance trade off: having fewer parameters, the full covariance ML-KBE and global MLE estimators are less flexible than the MLE and MLL estimators; however, those parameters can be estimated with greater reliability, leading to the best performance in many cases [4].

From the theoretical and empirical results in this work it is clear that the optimal estimator should somehow function like the full covariance ML-KBE estimator in regions with low spatial variability, and must function like the MLE estimator and be able to adapt bandwidths in regions with high spatial variability, especially for outliers [5]. We therefore believe that it would be interesting to investigate a hybrid kernel bandwidth estimator by first detecting and removing outliers. We have presented the global kernel k-means clustering algorithm, an algorithm that maps data points from input space to a higher dimensional feature space through the use of a kernel function and optimizes the clustering error in the feature space by locating near optimal minima [6]. The main advantages of this method are its deterministic nature, which makes it independent of cluster initialization, and the ability to identify nonlinearly separable clusters in input space. Another important feature of the proposed algorithm is that in order to solve the M -clustering problem all intermediate clustering problems, with $1 \dots M$ clusters, are solved [7]. This may prove useful in problems where we seek the actual number of clusters. Moreover we developed the fast global kernel k-means algorithm which considerably reduces the computational cost of the original algorithm without degrading significantly the quality of the solution [8].

We proposed a new adaptive semi-supervised Kernel K-Means algorithm. Our approach integrates the given constraints with the kernel function, and is able to automatically embed, during the clustering process, the optimal non-linear similarity within the feature space [9]. As a result, the proposed algorithm is capable of discovering clusters with non-linear boundaries in input space with high accuracy. Our technique enables the practical utilization of powerful kernel-based semi-supervised clustering approaches by providing a mechanism to automatically set the involved critical parameters [10]. In this approach, we observed that weighted kernel k-means updating of views according to their conveyed information resulting higher clustering accuracy, if the sparsity of the weights is appropriately moderated [11]. The threads concept we used in the algorithm for initializing clusters is working good and resulting in reduced run time and also provided us an interesting direction for developing and improving multi-view clustering algorithms [12].

X. FUTURE WORK

Clustering can then be performed on the remaining data and the full covariance ML-KBE bandwidth estimator can be used to estimate a unique full covariance kernel bandwidth for each cluster-each kernel will thus make use of the full covariance bandwidth matrix of the cluster to which it is assigned [1]. The MLE estimator can then be used to estimate a unique bandwidth for each outlier; since the MLE estimator can model scale variations, this will ensure that outliers have sufficiently wide bandwidths [2]. This proposed hybrid approach will thus generally function like the full covariance ML-KBE estimator in the clustered regions and has the added ability to change the direction of local scale variations between clusters [4]. This estimator will also be capable of making the bandwidths of kernel function centred on outliers sufficiently wide. We therefore propose to implement this hybrid ML kernel bandwidth estimator in future work and perform a comparative study between this

approach, the MLE, full covariance ML-KBE and the first hybrid approach proposed above [3]. As for future work a possible direction is the use of parallel processing to accelerate the global kernel k-means algorithm since the local search performed when solving the k clustering problem requires running kernel k-means N times and these executions are independent of each other [8]. Another important issue is the development of theoretical foundations behind the assumptions of the method. As already mentioned kernel k-means is closely related to spectral clustering. So extending the proposed algorithm by associating weights with each data point, following the ideas in [6], and using it to solve graph cut problems and comparing it to spectral methods is another possible research direction. Finally we plan to use the global kernel k-means in conjunction with criteria and techniques for estimating the optimal number of clusters [5].

As for future work, a possible direction is the use of parallel processing to accelerate the global kernel k-means algorithm, since the local search performed when solving the k -clustering problem requires running kernel k-means times and these executions are independent of each other [7]. Another important issue is the development of theoretical results concerning the near-optimality of the obtained solutions [1]. Also, we plan to use global kernel k-means in conjunction with criteria and techniques for estimating the optimal number of clusters and integrate it with other exemplar-based techniques. Finally, the application of this algorithm to graph partitioning needs further investigation and a comparison with spectral methods and other graph clustering techniques is required [10]. In our future work we will consider active learning as a methodology to generate constraints which are most informative. We will also consider other kernel functions (e.g., polynomial) in our future experiments, as well as combinations of different types of kernels [9]. In future, we planned to parallelize the same algorithm using multi-core processing environment for reducing the run time to overcome the synchronization problem raised from thread concept. And we also planned to extend the algorithm for larger multi-modal Datasets (Big Data) [11].

There are a number of interesting potential avenues for future research in kernel methods for semi-supervised clustering. Along with learning the kernel matrix before the clustering, one could additionally incorporate kernel matrix learning in to the clustering iteration, as was done [4]. One way to incorporate learning in to the clustering step is to devise away to learn the weights in weighted kernel k-means, by using the constraints [2]. Another possibility would be to explore the generalization of techniques in this paper beyond squared Euclidean distance, for unifying semi-supervised graph clustering with kernel-based clustering on an HMRF using other popular clustering distortion measures, e.g., KL-divergence, or cosine distance [12]. We would also like to extend the work of to explore techniques of active learning and model selection in the context of semi-supervised kernel clustering. To speed up the algorithm further, the multi-level methods of can be employed [13].

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Track A: Security

Access control, Anonymity, Audit and audit reduction & Authentication and authorization, Applied cryptography, Cryptanalysis, Digital Signatures, Biometric security, Boundary control devices, Certification and accreditation, Cross-layer design for security, Security & Network Management, Data and system integrity, Database security, Defensive information warfare, Denial of service protection, Intrusion Detection, Anti-malware, Distributed systems security, Electronic commerce, E-mail security, Spam, Phishing, E-mail fraud, Virus, worms, Trojan Protection, Grid security, Information hiding and watermarking & Information survivability, Insider threat protection, Integrity

Intellectual property protection, Internet/Intranet Security, Key management and key recovery, Language-based security, Mobile and wireless security, Mobile, Ad Hoc and Sensor Network Security, Monitoring and surveillance, Multimedia security, Operating system security, Peer-to-peer security, Performance Evaluations of Protocols & Security Application, Privacy and data protection, Product evaluation criteria and compliance, Risk evaluation and security certification, Risk/vulnerability assessment, Security & Network Management, Security Models & protocols, Security threats & countermeasures (DDoS, MiM, Session Hijacking, Replay attack etc.), Trusted computing, Ubiquitous Computing Security, Virtualization security, VoIP security, Web 2.0 security, Submission Procedures, Active Defense Systems, Adaptive Defense Systems, Benchmark, Analysis and Evaluation of Security Systems, Distributed Access Control and Trust Management, Distributed Attack Systems and Mechanisms, Distributed Intrusion Detection/Prevention Systems, Denial-of-Service Attacks and Countermeasures, High Performance Security Systems, Identity Management and Authentication, Implementation, Deployment and Management of Security Systems, Intelligent Defense Systems, Internet and Network Forensics, Large-scale Attacks and Defense, RFID Security and Privacy, Security Architectures in Distributed Network Systems, Security for Critical Infrastructures, Security for P2P systems and Grid Systems, Security in E-Commerce, Security and Privacy in Wireless Networks, Secure Mobile Agents and Mobile Code, Security Protocols, Security Simulation and Tools, Security Theory and Tools, Standards and Assurance Methods, Trusted Computing, Viruses, Worms, and Other Malicious Code, World Wide Web Security, Novel and emerging secure architecture, Study of attack strategies, attack modeling, Case studies and analysis of actual attacks, Continuity of Operations during an attack, Key management, Trust management, Intrusion detection techniques, Intrusion response, alarm management, and correlation analysis, Study of tradeoffs between security and system performance, Intrusion tolerance systems, Secure protocols, Security in wireless networks (e.g. mesh networks, sensor networks, etc.), Cryptography and Secure Communications, Computer Forensics, Recovery and Healing, Security Visualization, Formal Methods in Security, Principles for Designing a Secure Computing System, Autonomic Security, Internet Security, Security in Health Care Systems, Security Solutions Using Reconfigurable Computing, Adaptive and Intelligent Defense Systems, Authentication and Access control, Denial of service attacks and countermeasures, Identity, Route and

Location Anonymity schemes, Intrusion detection and prevention techniques, Cryptography, encryption algorithms and Key management schemes, Secure routing schemes, Secure neighbor discovery and localization, Trust establishment and maintenance, Confidentiality and data integrity, Security architectures, deployments and solutions, Emerging threats to cloud-based services, Security model for new services, Cloud-aware web service security, Information hiding in Cloud Computing, Securing distributed data storage in cloud, Security, privacy and trust in mobile computing systems and applications, **Middleware security & Security features:** middleware software is an asset on

its own and has to be protected, interaction between security-specific and other middleware features, e.g., context-awareness, **Middleware-level security monitoring and measurement:** metrics and mechanisms for quantification and evaluation of security enforced by the middleware, **Security co-design:** trade-off and co-design between application-based and middleware-based security, **Policy-based management:** innovative support for policy-based definition and enforcement of security concerns, **Identification and authentication mechanisms:** Means to capture application specific constraints in defining and enforcing access control rules, **Middleware-oriented security patterns:** identification of patterns for sound, reusable security, **Security in aspect-based middleware:** mechanisms for isolating and enforcing security aspects, **Security in agent-based platforms:** protection for mobile code and platforms, Smart Devices: Biometrics, National ID cards, Embedded Systems Security and TPMs, RFID Systems Security, Smart Card Security, Pervasive Systems: Digital Rights Management (DRM) in pervasive environments, Intrusion Detection and Information Filtering, Localization Systems Security (Tracking of People and Goods), Mobile Commerce Security, Privacy Enhancing Technologies, Security Protocols (for Identification and Authentication, Confidentiality and Privacy, and Integrity), Ubiquitous Networks: Ad Hoc Networks Security, Delay-Tolerant Network Security, Domestic Network Security, Peer-to-Peer Networks Security, Security Issues in Mobile and Ubiquitous Networks, Security of GSM/GPRS/UMTS Systems, Sensor Networks Security, Vehicular Network Security, Wireless Communication Security: Bluetooth, NFC, WiFi, WiMAX, WiMedia, others

This Track will emphasize the design, implementation, management and applications of computer communications, networks and services. Topics of mostly theoretical nature are also welcome, provided there is clear practical potential in applying the results of such work.

Track B: Computer Science

Broadband wireless technologies: LTE, WiMAX, WiRAN, HSDPA, HSUPA, Resource allocation and interference management, Quality of service and scheduling methods, Capacity planning and dimensioning, Cross-layer design and Physical layer based issue, Interworking architecture and interoperability, Relay assisted and cooperative communications, Location and provisioning and mobility management, Call admission and flow/congestion control, Performance optimization, Channel capacity modeling and analysis, Middleware Issues: Event-based, publish/subscribe, and message-oriented middleware, Reconfigurable, adaptable, and reflective middleware approaches, Middleware solutions for reliability, fault tolerance, and quality-of-service, Scalability of middleware, Context-aware middleware, Autonomic and self-managing middleware, Evaluation techniques for middleware solutions, Formal methods and tools for designing, verifying, and evaluating, middleware, Software engineering techniques for middleware, Service oriented middleware, Agent-based middleware, Security middleware, Network Applications: Network-based automation, Cloud applications, Ubiquitous and pervasive applications, Collaborative applications, RFID and sensor network applications, Mobile applications, Smart home applications, Infrastructure monitoring and control applications, Remote health monitoring, GPS and location-based applications, Networked vehicles applications, Alert applications, Embedded Computer System, Advanced Control Systems, and Intelligent Control : Advanced control and measurement, computer and microprocessor-based control, signal processing, estimation and identification techniques, application specific IC's, nonlinear and adaptive control, optimal and robot control, intelligent control, evolutionary computing, and intelligent systems, instrumentation subject to critical conditions, automotive, marine and aero-space control and all other control applications, Intelligent Control System, Wiring/Wireless Sensor, Signal Control System. Sensors, Actuators and Systems Integration : Intelligent sensors and actuators, multisensor fusion, sensor array and multi-channel processing, micro/nano technology, microsensors and microactuators, instrumentation electronics, MEMS and system integration, wireless sensor, Network Sensor, Hybrid

Sensor, Distributed Sensor Networks. Signal and Image Processing : Digital signal processing theory, methods, DSP implementation, speech processing, image and multidimensional signal processing, Image analysis and processing, Image and Multimedia applications, Real-time multimedia signal processing, Computer vision, Emerging signal processing areas, Remote Sensing, Signal processing in education. Industrial Informatics: Industrial applications of neural networks, fuzzy algorithms, Neuro-Fuzzy application, bioInformatics, real-time computer control, real-time information systems, human-machine interfaces, CAD/CAM/CAT/CIM, virtual reality, industrial communications, flexible manufacturing systems, industrial automated process, Data Storage Management, Harddisk control, Supply Chain Management, Logistics applications, Power plant automation, Drives automation. Information Technology, Management of Information System : Management information systems, Information Management, Nursing information management, Information System, Information Technology and their application, Data retrieval, Data Base Management, Decision analysis methods, Information processing, Operations research, E-Business, E-Commerce, E-Government, Computer Business, Security and risk management, Medical imaging, Biotechnology, Bio-Medicine, Computer-based information systems in health care, Changing Access to Patient Information, Healthcare Management Information Technology. Communication/Computer Network, Transportation Application : On-board diagnostics, Active safety systems, Communication systems, Wireless technology, Communication application, Navigation and Guidance, Vision-based applications, Speech interface, Sensor fusion, Networking theory and technologies, Transportation information, Autonomous vehicle, Vehicle application of affective computing, Advance Computing technology and their application : Broadband and intelligent networks, Data Mining, Data fusion, Computational intelligence, Information and data security, Information indexing and retrieval, Information processing, Information systems and applications, Internet applications and performances, Knowledge based systems, Knowledge management, Software Engineering, Decision making, Mobile networks and services, Network management and services, Neural Network, Fuzzy logics, Neuro-Fuzzy, Expert approaches, Innovation Technology and Management : Innovation and product development, Emerging advances in business and its applications, Creativity in Internet management and retailing, B2B and B2C management, Electronic transceiver device for Retail Marketing Industries, Facilities planning and management, Innovative pervasive computing applications, Programming paradigms for pervasive systems, Software evolution and maintenance in pervasive systems, Middleware services and agent technologies, Adaptive, autonomic and context-aware computing, Mobile/Wireless computing systems and services in pervasive computing, Energy-efficient and green pervasive computing, Communication architectures for pervasive computing, Ad hoc networks for pervasive communications, Pervasive opportunistic communications and applications, Enabling technologies for pervasive systems (e.g., wireless BAN, PAN), Positioning and tracking technologies, Sensors and RFID in pervasive systems, Multimodal sensing and context for pervasive applications, Pervasive sensing, perception and semantic interpretation, Smart devices and intelligent environments, Trust, security and privacy issues in pervasive systems, User interfaces and interaction models, Virtual immersive communications, Wearable computers, Standards and interfaces for pervasive computing environments, Social and economic models for pervasive systems, Active and Programmable Networks, Ad Hoc & Sensor Network, Congestion and/or Flow Control, Content Distribution, Grid Networking, High-speed Network Architectures, Internet Services and Applications, Optical Networks, Mobile and Wireless Networks, Network Modeling and Simulation, Multicast, Multimedia Communications, Network Control and Management, Network Protocols, Network Performance, Network Measurement, Peer to Peer and Overlay Networks, Quality of Service and Quality of Experience, Ubiquitous Networks, Crosscutting Themes – Internet Technologies, Infrastructure, Services and Applications; Open Source Tools, Open Models and Architectures; Security, Privacy and Trust; Navigation Systems, Location Based Services; Social Networks and Online Communities; ICT Convergence, Digital Economy and Digital Divide, Neural Networks, Pattern Recognition, Computer Vision, Advanced Computing Architectures and New Programming Models, Visualization and Virtual Reality as Applied to Computational Science, Computer Architecture and Embedded Systems, Technology in Education, Theoretical Computer Science, Computing Ethics, Computing Practices & Applications

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